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FACTORS IN CHEMICAL COSTS

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For Unparalleled Successes in 1937...

Vulcan thanks

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DURING the year just closed Vulcan enjoyed the largest volume of business in its long history. And for this evidence of confidence in its ability to serve the chemical industry . . . Vulcan is truly grateful.

In 1937 the Vulcan organization designed and built Distillation and Evaporation equipment for practically every conceivable type of operation. Installations were made throughout the United States and in many foreign countries.

To better serve our many new friends and those of long standing, Vulcan is now completing an expansion program which includes increased engineering and process development facilities and plant additions which will double production capacity.

Now, more than ever before, it will pay to consult Vulcan concerning all problems involving . . .

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CINCINNATI, OHIO

FEBRUARY 1938

FACTORS IN CHEMICAL COSTS

A DISTINGUISHED ECONOMIST, writing in this issue, says in effect: The answer to industry's *outside* problems lies *inside* the plant. After giving due consideration to the economic and governmental obstacles in the path of general business recovery, he concludes that the individual manufacturer can accomplish most by keeping his prices as low as possible and thereby stimulating consumption. Further, that the greatest single contribution of the chemical engineer lies in increasing efficiency in order to offset higher taxes, rising wages and all the many other disturbing factors in chemical costs. So, hand in hand, manufacturer and engineer must dedicate themselves anew to that cardinal principle of chemical progress: More goods at lower prices!

With this concentration of attention on chemical costs, perhaps we are justified in deserting our technology long enough to make a thorough study of those economic factors which, in the end, determine the success or failure of nearly every chemical enterprise. Because the principles of accounting give us the historical records, calculations and estimates on which management must depend for exact knowledge of any business, it is appropriate that we start our study in the office of the comptroller. We want to know what thinking underlies his methods and measures. With a famous lawyer, we may inquire as to "how many guesses lurk behind the figures to which he (the accountant) has given mathematical exactitude?"

Bookkeeping methods may sometimes seem puzzling and bothersome to the chemical engineer but the time is coming in chemical industry when unified thought and standardized accounting practices will greatly advance and clarify the understanding of every phase of our business. The comptroller of Monsanto has contributed much to that cause in his article in this issue. It is to be hoped that other companies will be willing to talk with equal frankness about their accounting practices and costing methods.

How to get the money for a new enterprise is often an important factor in chemical costs. Especially is this true today when an unfair tax law would seem to stifle new plant construction and, at the same time, other regulating agencies make it more difficult to reach and attract the investor. Fortunately, an experienced guide is on hand to lead us safely through the maze of S.E.C. regulations and the catacombs of Wall Street.

Transportation and insurance—once taken for granted or assigned to a young and willing clerk—now call for mature thought from chemical management. Savings as a result of false economy in either direction can prove extremely costly. Labor problems underlie so much of our present difficulties that they are fundamental in any consideration of chemical costs. A resourceful and impartial observer, who has been carefully studying labor trends and developments for many months, gives us views that are both interesting and helpful. And, finally, to round out our symposium, other competent contributors discuss construction costs, research accounting and depreciation rates for process equipment.

Thus this Fifteenth Annual Review and Statistical number of *Chem. & Met.* finds its basic editorial theme in the economic factors that affect chemical costs. From this viewpoint are presented the commodity and raw material studies and the basic industrial statistics that are not available in any other publication. All this information, we hope, can be put to prompt and effective use in chemical industry. Not in a long time has there been a greater opportunity for efficient technology when backed by sound economics.

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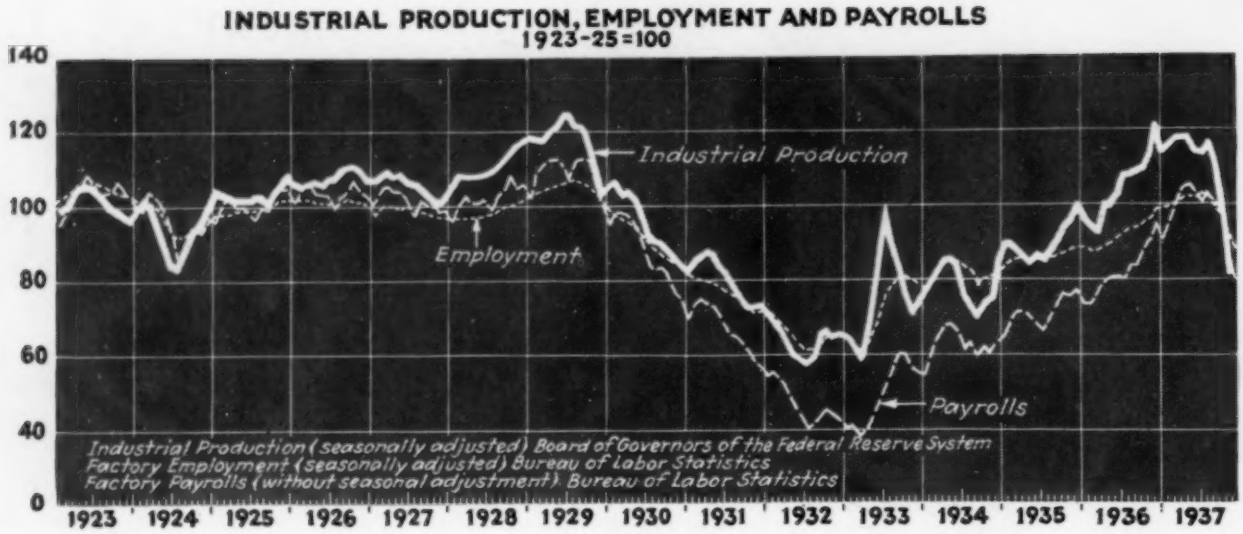


What is the ECONOMIC OUTLOOK?

By PAUL W. STEWART

DIRECTOR OF RESEARCH
ANDERSON, NICHOLS ASSOCIATES
NEW YORK

Although co-author with Rufus S. Tucker of the recent Twentieth Century Fund monograph: "The National Debt and Government Credit," Mr. Stewart is primarily a specialist in marketing studies and the technique of economic research. He was formerly chief business specialist in charge of the special trade studies section of the U. S. Bureau of Foreign and Domestic Commerce. As the author of "Market Data Handbook of the United States" he received the Harvard Bok Award in 1929 for distinguished research in advertising. Subsequently he was director of market research for the A. O. Smith Corporation. For the past three years he has been in charge of the marketing and research staff of Anderson, Nichols Associates and has conducted research for the Twentieth Century Fund

TODAY WE STAND at the economic crossroads and, according to some, the political crossroads as well. The latter believe that the course of government is leading us toward a basic change in the relationship between the government and the individual. The trend, they say, is in the direction of a strongly centralized federal government in which not only the individual but also the states and other political subdivisions play a minor rôle. Those who believe that such a fundamental change is taking place are divided into two schools—those who look askance and frequently with alarm and those who view the situation with satisfaction.

As in most matters of such diverse opinion it may well be that neither the worst fears of the ultra-conservative nor the fondest hopes of the visionaries will be fulfilled. It may be that the United States today is merely passing through a transition stage similar to that experienced in England—an evolutionary process by which a mature industrial nation's economy becomes so complex as to need a larger degree of government supervision and regulation. It should be carefully noted, however, that the *manner* in which the government proceeds in the development and exercise of these functions will have a profound effect upon business. Specific laws aimed at these objectives may be sound and in line with public interest, but they must be properly and sympathetically administered if government and business are to get along in harmony. Furthermore policies and rules should be made definite and publicly announced so as to remove uncertainty.

Whether we stand today at any such critical point in the long-range view of affairs may well be a matter of opinion, but there is little disagreement that the next six months will determine whether we are to slip back toward mid-depression levels or whether we are to resume our upward path toward prosperous business conditions. As a matter of fact, even at the height of our business activity prior to the recession we had not reached the normal level of production. This is in spite of the fact that the physical quantity of goods being turned out at that time was nearly equal to the average amount produced in 1929. This is because our population has increased by about 8 million in the years since 1929, so that the same total production in 1937 would be considerably less on a per capita basis.

The decline in industrial activity from the December, 1936 peak, which was almost equalled as late as August of last year, marks one of the sharpest curtailments in production which this country has ever seen. According to the Federal Reserve index, physical production fell from 117 in August to 89 in November and to about 84 for December, the last figure available, or a decline of about 28 per cent in four months. As to the immedi-

ate future, say until the middle of 1938, most observers agree that it is unlikely that any marked upturn wil occur. On the other hand, it is not unlikely that the average for the first six months of the current year will be around the level for November, 1937, which still would be far below normal.

What actually lies in the months ahead is impossible to forecast. It seems clear that the course of industry in the future is definitely tied up with what the federal administration in Washington will do about taxation, budgetary and financial policies, and the regulation of business. It should be emphasized in this connection that it is not only overt acts but also attitudes which count. Confidence, both business and public, is a fragile thing which is difficult to define or measure. If it is present we go forward serenely; if it is lacking we are apt to stumble over obstacles which would normally be completely ignored.

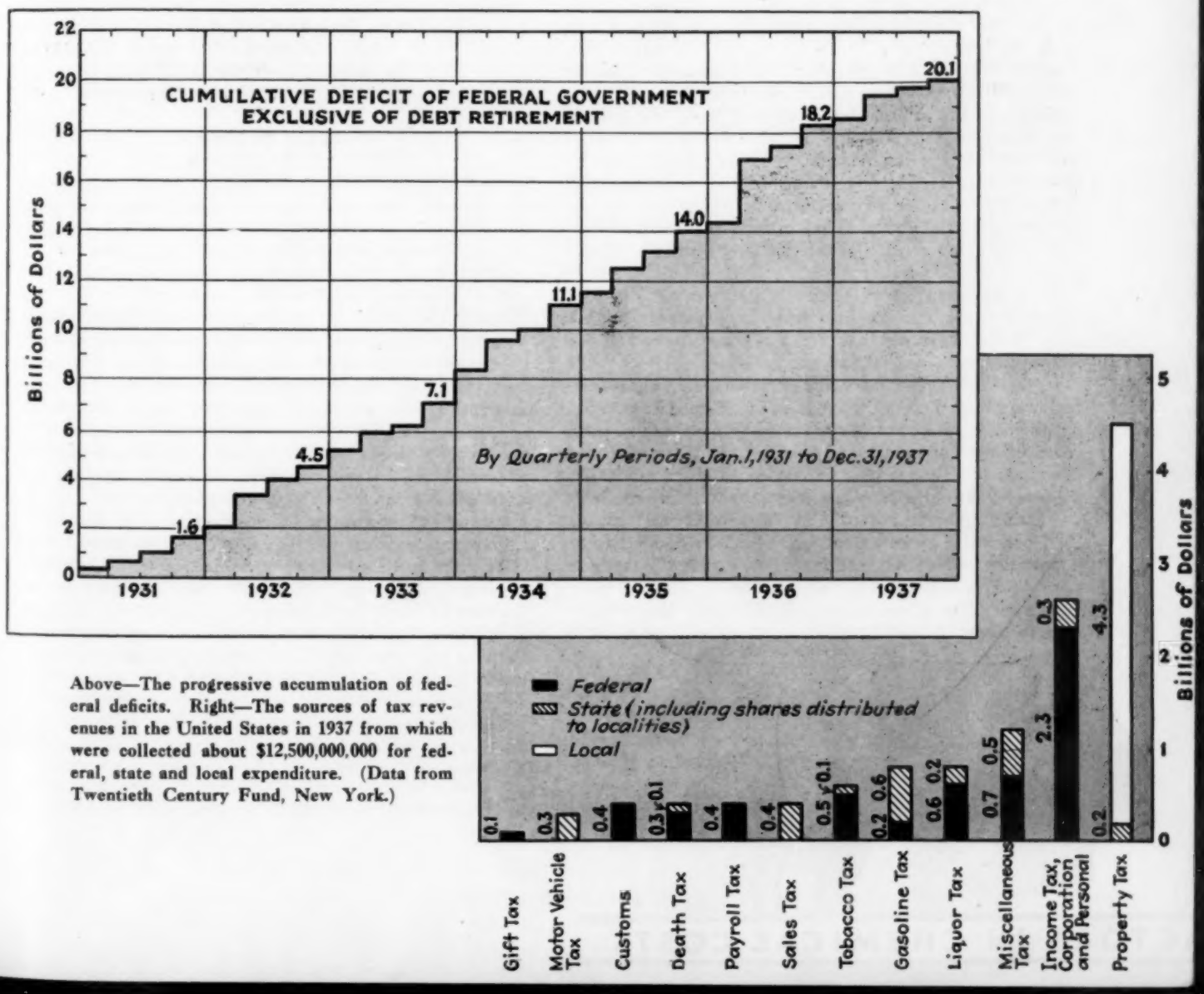
Effect of Wars

The future is also clouded by possible developments in foreign countries. If for example the wars in Spain or China were to break over their present boundaries and involve any of the major European countries, these developments would have a deterring effect on American business. Likewise a severe breakdown in the foreign financial situation would have repercussions of a very serious nature on the financial community in this country.

At this point, also, it might be noted that the present high rate of industrial activity in a number of European countries might be adversely affected in the event that the recession in America continues for a considerable length of time, and if this were to take place the results would probably in turn affect American business unfavorably. Barring unforeseen developments, however, we may depend upon domestic affairs to govern our course.

It is entirely probable that a large number of factors contributed to the decline in business, and most of them have been influenced by government policies, either directly or indirectly. A foundation for inflation was laid by the methods employed in financing Federal Government deficits and many economists urged the administration to exercise its powers of control in the event that prices showed a tendency to get out of hand. An early balancing of the budget was also thought to be imperative. In the spring of 1937, the Administration moved in both directions. A warning that prices were advancing too rapidly was issued; reserve requirements of banks were increased, thereby curtailing credit expansion; and at the same time, efforts were made to balance the budget by reducing expenditures.

Business was supposed to step into the breach caused by the Government's ceasing to pour purchasing power into the national market. But a number of circumstances interfered with this process. In the first place the ad-



Above—The progressive accumulation of federal deficits. Right—The sources of tax revenues in the United States in 1937 from which were collected about $12,500,000,000 for federal, state and local expenditure. (Data from Twentieth Century Fund, New York.)

justment could not take place so rapidly. But perhaps even more fundamentally, many business men had had their confidence shaken in the future of industrial profits. The demands of labor on one hand and the taxation and regulation of business by government on the other contributed to the uncertainty. Labor troubles in the early part of the year caused many manufacturers to build up excessively large inventories for fear their source of supply might be temporarily cut off. Then, too, prices of raw materials and labor costs had been going up and it was only natural for manufacturers to attempt to safeguard their future competitive position.

Prices and labor costs are still important factors in the situation. Prices of raw materials have in most cases gone down in recent months but labor costs have shown little sign of flexibility and adjustment downward, despite the fact that both costs and prices of finished goods must be brought into line with purchasing power before any degree of stability can be assured.

Upsetting the Economic Equilibrium

The studies of the Brookings Institution clearly show that high prices and high wages are not necessary to produce a high standard of living. It is the relationship between purchasing power on one hand and prices which the consumer must pay on the other which determine economic equilibrium. It is perfectly possible for low money wages to represent high purchasing power if prices are correspondingly low.

Furthermore, it should be emphasized that it is undesirable for manufacturing wages to get out of line with the income of other segments of the population. Thus, if by virtue of the efforts of organized labor or government, wages in manufacturing industries are raised rapidly and the salaries and wages of those engaged in non-manufacturing activities remain at the same level, the costs and prices of manufactured goods may be raised to a point where it is difficult for people engaged in agriculture, the service occupations and professions to buy manufactured goods. This, in turn, reduces the effective demand for goods and consequently results in unemployment in industry.

It is apparent, therefore, that all elements in the economic structure are interdependent and one cannot gain to the detriment of others without throwing the whole economic mechanism out of gear.

It is real wages that count—not money wages—and real wages are dependent on how much goods the wage dollar will buy. If prices are raised as the result of high costs of raw materials and labor, it is clear that not only industrial wages must be raised to a corresponding degree but also the average wage earner's income.

Another important factor in cost which has always been present to some extent but which is of increasing importance today is taxation. The average American now pays, either directly or indirectly, $100 a year in taxes. The government—federal, state and local—collects about $12,500,000,000 in taxes yearly—a little less than a fifth of the national income, the heaviest tax burden in our history. The extent and the character of the taxes levied on business have not only raised costs but have impaired initiative. The undistributed profits tax, generally admitted to be a deterrent factor has rather special significance for the chemical and process industries. These have made their phenomenal progress because of readiness to invest in new ventures and ideas. Ability to do this was largely due to the building up of reserves to finance new developments and new plant when existing processes and equipment were outmoded. The undistributed profits tax penalizes the very policies that have made the chemical industry what it is, by forcing manufacturers either to pay out a very large share of their profits in dividends or to hand them over to the government.

Earlier in the discussion it was stated that economists a year ago were giving warning of the threat of inflation. Lest one be lulled into a false sense of security by the opposite tendencies which are in evidence today, it is well to bear in mind that the groundwork for inflation is present as much today as ever. This arises principally from the size of the federal deficits—aggregating more than 20 billion since January 1, 1931—and from the methods of financing these deficits, which was done through the banking system—a process which at least lays the basis for credit inflation. In spite of the fact that social security taxes in the past year made it unnecessary to employ this method of financing, the amount of credit expansion possible on the basis of Government obligations now held by the Federal Reserve and member banks is greater than that which occurred during the World War. Furthermore, if the deficit in 1939 is larger than the receipts from the social security taxes, it may be necessary to resume financing through the banks.

What to Do?

In the face of these rather discouraging comments on the general economic outlook, the reader may well ask, "What's to be done?" Without wishing to sound off as an oracle nor yet to exhibit the naiveté of one unfamiliar with the problems of chemical industry, the author suggests just two conclusions:

First, the policy of all manufacturers should aim at keeping prices as low as possible in order to stimulate consumption. Obviously, this does not mean that products should be sold below their cost. On the other hand in figuring new price schedules, it would seem desirable to seek profits in increased sales rather than in long mark-up. Chemical industry has been notable for its adherence to this policy, which is one of the reasons it held up so well during the depression.

The second suggestion is closely related to the first—Lower costs wherever possible. Higher taxes, high labor rates and shorter hours must be offset by increased efficiency. Although it is seldom that direct labor and distribution costs in the chemical industry are dominant elements in total costs, they are of increasing importance. Perhaps it is true that the industry has concentrated too much emphasis on the development of new products and processes with relatively too little attention to the possibilities which lie in the reduction of labor and distribution costs. Herein lie the answers to many of the economic problems of the industry.

ACTORS IN CHEMICAL COSTS

COUNTING CHEMICAL COSTS

Accounting Practices of Monsanto Chemical Company

By D. M. SHEEHAN
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ST. LOUIS, MO.

Mr. Sheehan has been actively engaged in cost accounting work since his graduation from Washington University's school of business administration in 1925. He holds Certified Public Accountants Certificates from the States of Missouri and Tennessee and is a member of the American Institute of Accountants. Formerly with Haskins & Sells, certified public accountants, he now serves the Monsanto Chemical Co. in the capacity of comptroller, and therefore is in a particularly qualified position to present the following case study of this company's modern chemical cost accounting practices.

•

WITH MODERN BUSINESS becoming more complex, it is essential to the success of a company that it have a sound, well-defined accounting system and organization. The system itself must be complete in respect to the records used for the summarization of transactions and to the reports prepared. The accounting personnel must be well trained, intelligent and ever alert to grasp and develop ideas which will lead to the improvement of existing accounting practices and the further serving of the management in its direction of company affairs.

It is the most important duty of the person entrusted with guiding the accounting destinies of a business to present to the management at all times accurate data as they are developed through the accounts, regardless of whether they are favorable or unfavorable from the standpoint of operating results or their effect on an individual or group of individuals. Fortunately, this principle appears to be becoming more generally recognized.

An attempt will be made in this article to explain the philosophy underlying the accounting practices of the Monsanto Chemical Co. and to present outlines of some of these practices. Because of limitations in space, such descriptions must necessarily be rather general, but an effort will be made to present them in sufficient detail to enable the reader to gain some specific information.

The keynote of Monsanto's accounting practice is accuracy with a leaning toward conservatism. With respect to accuracy, an attempt is made to obtain exact figures for not only the fiscal year but for each month of the year. We strive to have each month's figures reflect the true operating results for the month, and frown upon procedure which contemplates year-end adjustments. Actual figures are used almost entirely at all times during the year, the books of the company being practically devoid of estimated figures. For example: (a) each month an effort is made to take into account all vendors' invoices applicable to that month, (b) sales for the entire month are recorded on the books, (c) physical inventories of all work in process and finished goods are taken monthly, and (d) depreciation is provided monthly on the basis of the property values at the beginning of each month.

With respect to conservatism, it is our policy to have our accounts reflect conservative values of all assets, and to include all known liabilities. In our opinion, however, violence can be done to good accounting practice by being too conservative through understating asset values, overstating liabilities, and providing excessive reserves. We exercise care to avoid showing an erroneous financial position resulting from ultra conservatism in the valuation of our net assets. It is only proper that the stockholder be apprised at all times of the true book value of his holdings in the company.

Provision for Losses

It is our policy to anticipate losses and immediately provide for them in the accounts, rather than defer their recording until actual occurrence. To illustrate the point, if we feel with some degree of certainty that a large unit of our plant property will become obsolete and know that such unusual loss is not provided for in the regular

reserve for obsolescence, we immediately provide for this loss in the accounts, even though the unit may not be abandoned until some future date. The purpose behind this practice is a desire to have our net income at all times reflect all possible known losses. We do not favor the idea of having to deduct mentally from recorded earnings probable losses which have not been reflected in the accounts. If such anticipated losses do not eventuate, income or surplus is credited with the provisional amounts previously charged for the losses.

Our accounting procedure comprehends the setting aside of reserves only for known or expected liabilities and losses. We do not consider it good accounting practice to establish a general reserve for contingencies. Such a reserve invites the indiscriminate charging to it of items which should more properly be charged directly to net income. The reserve for contingencies shown in our published reports represents principally provisions for insurance claims and possible additional Federal and State income taxes for prior years.

It is our policy to limit surplus entries to dividends on capital stock and to non-recurring items of exceptionally large amount, which if included in net income would materially distort the true earnings. Relatively small items applicable to prior years are not, in our opinion, proper charges or credits to surplus. We include such items in net income.

Responsibility in Control of Expenses

Another important feature of our accounting procedure is that the responsibility for every controllable expense of the company rests with some individual, and, with but a few minor exceptions, such expenses are classified in the accounts and reports according to the department responsible for them. To illustrate, the director of sales is accountable for all controllable selling expenses, and no such expense for which he is not accountable is charged to selling expense, nor included under this classification in the various operating reports. It has been our experience that this practice can be followed without resulting in improper expense classification. This feature of responsibility has been a significant factor in properly controlling the expenses of the company. It is apparent, however, that it is impracticable with respect to non-controllable items such as depreciation, insurance and taxes.

The accounting, including compilation of costs, for all divisions of Monsanto Chemical Co., except the Merrimac Division, is centralized in the general offices at St. Louis. An office force is maintained in each of the plants, and among the duties of these employees is the rendering of monthly reports to St. Louis covering labor and storeroom distribution and monthly production figures pertaining to the various production centers in the respective plants. All plant cost sheets and budget reports are prepared in St. Louis. This plan of centralization was adopted after thorough consideration, and has been the means of effecting substantial savings in accounting expense. Our experience has demonstrated that this centralization of accounting has not lessened our control over plant operations, but on the contrary has improved it. An identical accounting system is used in our Merrimac Division and in our British subsidiary, Monsanto Chemicals, Ltd., the accounting for the latter's two plants being centralized in London. The centralization of accounting has been made more practicable through the use of teletype machines. These machines are extensively used by us in America and England for the transmission of messages between plants and offices.

CTORS IN CHEMICAL COSTS

Controlling Plant Operations

The greater part of the funds of any company find their way into costs, either through the purchases of raw materials and supplies, or through the payment of wages. It is therefore only logical that plant operations be very carefully controlled.

One of the principal factors in controlling plant operations is a complete cost accounting system, supplemented with budgetary control. The use of incentive plans is also helpful. We feel that some progress has been made at Monsanto in the institution of methods for such control.

Our cost system might be termed a "Process Standard Cost System." Our various products are manufactured by certain processes, and we accumulate actual costs and have developed standard costs for each process and for all of our regular finished products. No attempt is made to establish standards for products in the development stage, such products being on the basis of actual cost.

There is such a diversity of opinion and practice with regard to the elements entering into cost of production that it seems desirable to state our practice in this connection. With few exceptions our costs contain no class of expense other than those which originate in or relate to the immediate plant. The exceptions are: (1) salaries and office expenses of certain executive officers who are charged with the responsibility of supervising the production of the various plants, and (2) all expenses of the purchasing department and 50 per cent of the traffic department expenses. No part of accounting department expense is charged to costs. Likewise factory costs are not burdened with research expenses on the theory that such expenses are not an element in the cost of manufacture, but are more in the nature of general expenses.

Under our plan of accounting for costs, each plant is divided into production centers which manufacture either a single product or a group of very closely related products. In addition to the production centers, there are the usual plant service departments. Actual costs are developed monthly covering each of the production centers and service departments, the latter costs being allocated to the production centers.

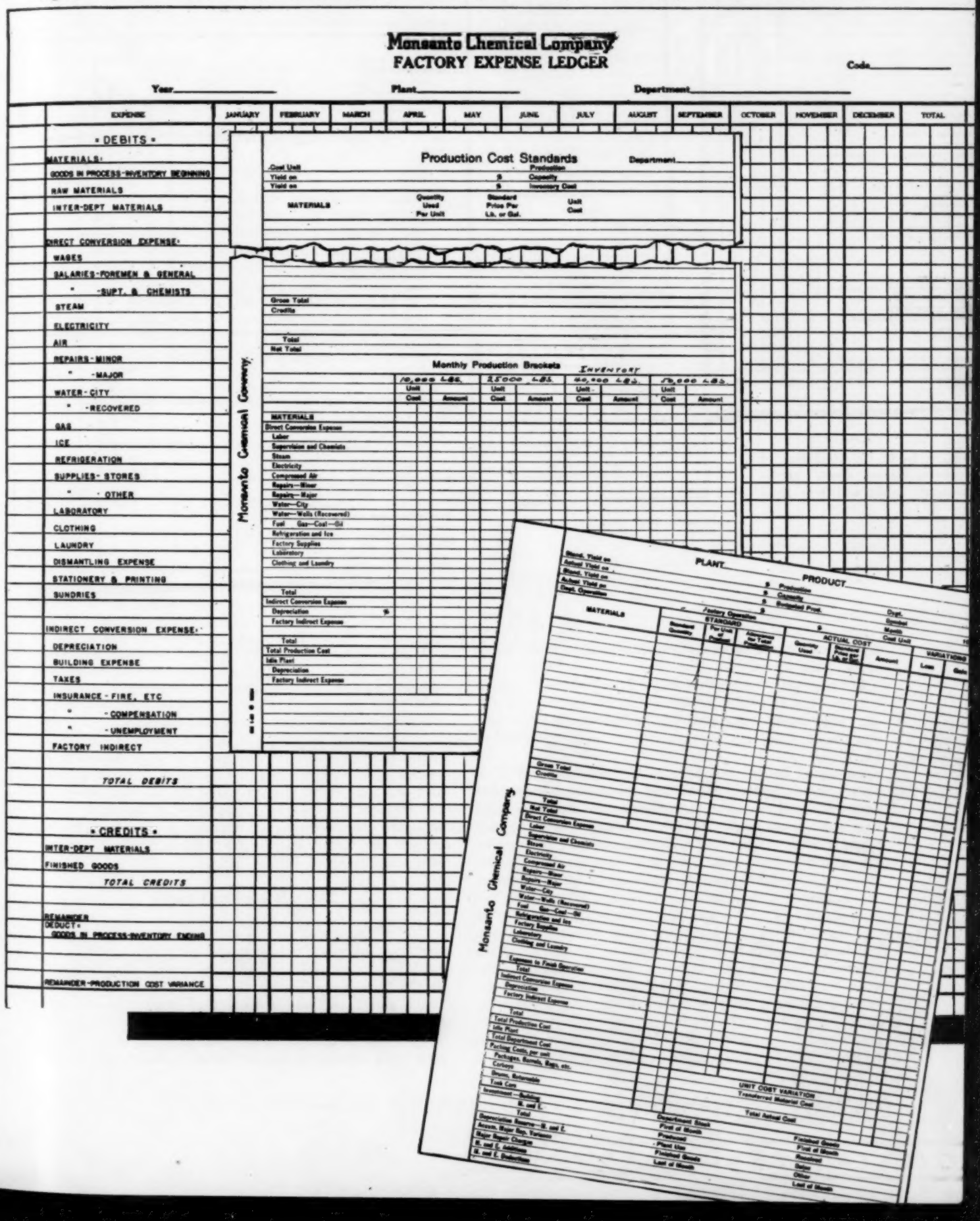
Raw Material Costs

Raw materials are one of the important elements of our costs. Standard costs have been established on most of our raw materials. This has been relatively easy since a large portion of these materials are purchased on contract. Raw materials are recorded in the inventory accounts at actual cost, but are charged to work in process (or cost of production) at standard costs. The difference between actual costs and standard costs of raw materials, due to differences in freight, handling costs, etc., is determined monthly and charged to a raw material variance

account. The raw material standard costs are revised whenever there are changes in contract prices. Labor, supplies and all other direct and indirect factory costs except major repairs, are charged to work in process at actual cost.

The distribution of factory burden is such an extensive subject that detailed descriptions of the bases we use in the allocation of service department expenses is not attempted in this article. Briefly, such costs are allocated either on the basis of actual usage (e.g., power plant and

Fig. 1, L. to R.—Monthly factory expense ledger, form for computation of cost standards, production-center cost sheet



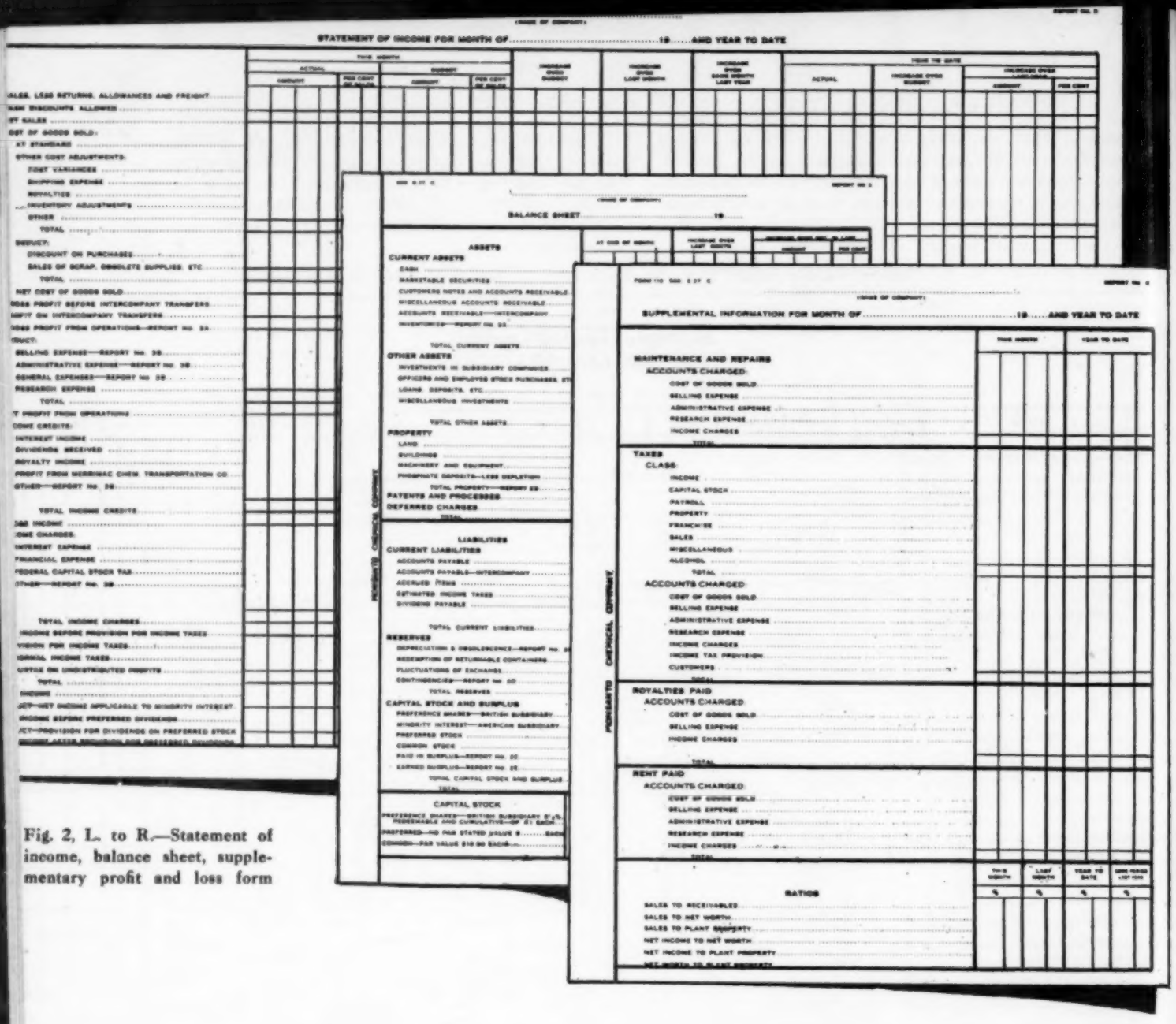


Fig. 2, L. to R.—Statement of income, balance sheet, supplementary profit and loss form

water department expenses), on the basis of direct labor, or on other bases.

For each plant an expense ledger is maintained in which are recorded monthly, by elements, the actual costs for each production center and service department. A reproduction of a factory expense ledger sheet is shown in Fig. 1.

As stated before, we have established standard costs on all regular products. These standards, which have been developed over a period of years, are based on labor time studies, on studies by the research department particularly with respect to yields on materials, on various other studies and tests, and on experience with actual costs. All expenses entering into the cost of the product are included in the standards. The form used for the computation of cost standards is shown in Fig. 1. It will be noted on this form that there is more than one standard established for a product. These correspond to various levels of production. The material costs remain constant, but certain of the direct and indirect conversion expenses vary with the volume of production. It will be noted further that one of these standards is designated "Inventory Standard," and is based upon the approximate capacity production of the department.

It is our practice to revise standard costs whenever there is a major change in any element. For example, changes in raw material prices or labor rates would be considered justification for revision of standards. Changes might be made at any time during the year, and it is interesting to note that we have made revisions as often as three times in one year. If it is necessary to reduce standard costs, the inventories of work in process and finished goods then on hand are written down on the basis of the reduced standards. On the other hand, such inventories are never revalued on the basis of increased standards. We use the "first-in, first-out" method of costing goods sold.

Why Standard Costs?

The two principal uses of standard costs are in connection with inventory valuation and budgetary control. All work in process and finished goods inventories are valued at the "Inventory Standard" cost. The differences between actual and standard costs of production are computed monthly by production centers and are designated as production cost variances. In order to show clearly how such variances are computed, a tabulation of the

various factors involved in their determination follows:

Work in Process inventory at beginning of period (at standard cost) ..... $——
Add:
Transfers of materials from other departments (at standard cost) ..... ——
Cost of production, including both direct and indirect expenses (at actual cost, except major repairs at standard) ..... —— ——
Total ..... $——
Deduct:
Transfers to other departments (at standard cost) ——
Transfers to finished goods inventory (at standard cost) ..... —— ——
Remainder ..... $——
Work in Process Inventory at end of period (at standard costs) ..... ——
Difference—production cost variance ..... $——

A debit production cost variance indicates that actual costs are in excess of standard costs; a credit variance shows that actual costs are less than standard costs.

Debit production cost variances may result from decreased production or operating inefficiency, while credit variances may result from increased production or above-normal operating efficiency. Either debit or credit cost variances can also result from defective standard costs.

It is our practice to analyze carefully each month the production cost variances for the purpose of determining their causes. The facts revealed by this study are promptly presented in the form of a report to interested parties.

In addition to the material and production cost variances, we compute monthly, with respect to each production and service department, the variance in major repairs. This represents the difference between the actual major repairs for the month and the amount of the standard or budgeted repairs charged to cost of production. Major repairs represent repair items costing $50 or more. Minor repairs represent items of less than that amount and are charged to cost of production at actual cost. The aggregate amount of the material, production cost, and repair variances is charged or credited monthly to cost of goods sold and included as a separate item under that caption in our monthly statement of income.

One of the major problems in our cost accounting is the evaluating of byproducts, which are either sold or used in the manufacture of other products. In determining the cost of the main product, cognizance must be taken of and credit given for the value of the byproduct. The method we have adopted with respect to those byproducts which are sold consists of deducting a certain percentage from the established sales price of each byproduct to cover selling, administrative and research expenses, and net profit. The remaining portion of the sales price after this deduction represents the cost value assigned to the byproduct, which is credited to the cost of producing the main product. The principal reason for adoption of this method is that it insures equitable distribution of cost to the main products and byproducts and results in valuing the latter at an amount which will yield a profit when they are sold. The method is also recommended by reason of its simplicity and the fact that it facilitates computation of costs. Byproducts used in further manufacture are transferred at standard costs which have been developed.

Monthly cost sheets covering each production center and certain of the service departments are prepared, a copy of which is reproduced in Fig. 1. These cost sheets are distributed to the executive officers, to the managers and certain of the operating chemists of the respective plants, and to other designated parties. The main section of the cost sheet is devoted to an exposition of the various cost elements, both as to actual costs and standard costs, and the variations of actual from standard. A perusal of the illustrated form will reveal that it also shows the following pertinent data:

Percentage of yields on various materials, both standard and actual.
Production, both actual and budgeted.
Capacity production.
The percentages of department and plant operations.
Amount of investment in equipment of the department.
Major repair charges, etc.

Budgetary Control

Budgetary control as established at Monsanto is divided into the usual two phases, namely, forecasting and budget control. By way of explanation, forecasting consists of estimating future financial position and operating results, while budget control is the means used for obtaining the forecast.

It is extremely difficult for a company with wide-spread operations to operate efficiently without a forecast or plan for the future. The period to be covered by such a plan differs among companies. Monsanto has before it at all times a forecast of its net income for a year in advance. This involves estimating each and every factor of net income for the period covered. Since the forecast shows earnings by months, it is revised monthly by adding the estimated net income for the twelfth month hence and deleting that for the month just ended. We are mainly concerned with projecting income and expense, construction expenditures, and cash position.

The most difficult and probably the most important feature of the income and expense estimate is sales. It is easy to visualize the difficulty of projecting for a year in advance with any degree of accuracy the sales of a company producing a large variety of products. The task requires a thorough study of customer needs, as well as business and market conditions. Because it is the basis for determining other factors of net income, the sales forecast must be as accurate as possible.

In forecasting cost of goods sold we take the expected sales quantities and apply to these our inventory cost standards in effect at the beginning of the period. The amount so obtained is adjusted by the variance between the cost of goods sold at the inventory standards (which are based on approximate capacity production) and at standards for the levels of production indicated by the estimated sales. In projecting the other factors of net income, such as selling, administrative and research expense, etc., past experience is a most important guide. All of the above forecasts involve consultation with executive officers, sales department officials and others, and

take into consideration all future changes, both known and in prospect.

The construction forecast, which consists of estimated construction expenditures by months for a year in advance, is prepared with the assistance of plant managers, engineers and others. It is also important that the executive officers be consulted periodically in this connection as the construction program is closely allied with the managerial policy of the business. This estimate of construction expenditures is a continuing one, that is, new items are periodically being added and old items reduced or removed as funds are expended. The forecast at all times reflects the estimate of construction expenditures by months for a year in advance.

In determining our required working capital, consideration is given to the seasonal fluctuations in inventories, to the additional cash required by any plant additions, and to other items.

Through the use of the foregoing methods we have been able to forecast our cash position with a surprising degree of accuracy. The form used for this purpose is reproduced in Fig. 3. A review of this form will show that we take into consideration the projected net income, estimated depreciation provision, and other provisions not requiring cash outlay. We also give effect to our construction forecast and the estimated amounts required for working capital, liquidation of liabilities, dividends, and other items.

As to budget control, the plan at Monsanto includes a flexible budget for controlling plant operations and a fixed budget for controlling selling, administrative, general and research expenses. Previously in this article it has been explained that our standard costs are set at various levels of production. The standards represent the allowable or budgeted cost at these levels. Budgeted cost for any volume of production between the set levels can be obtained by interpolation of standard costs. The actual performance of each department as compared with the allowable or budgeted cost is shown on the cost sheet (Fig. 1).

The budgets for controlling selling, administrative, general and research expenses are fixed at the beginning of each fiscal year. It has been our experience that such expenses can best be controlled by not changing the fixed budgets unless some unforeseen major factor makes revision imperative.

As a means of further controlling plant expenses we operate a bonus plan whereby certain supervisors, chemists and other key men of the plant are given additional compensation based on savings effected by them on controllable items of cost. These savings represent the difference between actual costs and predetermined bonus standards.

Financial Reports

The work of the general accounting division of an accounting department consists mainly in the keeping of the general books of account, the preparation of all financial reports, preparation of tax returns, and the internal audit work of the company. It is vital that this division be well organized and its work carefully planned in order that financial reports and other information be properly and expeditiously prepared.

Reports relating to operations and other matters are most valuable to the management when they are timely. It is apparent that if figures for any month are presented at an early date in the following month, they are of great assistance in the conduct of the business. The management is then in a position to take immediate steps to correct any inefficiencies which may have occurred during the month. It is also important that all reports and data issued by the accounting department be presented in a clear, concise manner so they can be readily understood.

The general accounting division of Monsanto Chemical Co. has been organized with the foregoing principles in mind, and the results thus far have been encouraging. Through careful planning and coordination of the work and the records of this division with those of other divisions of the accounting department, we are able on the 10th of the month to furnish the management of the company with accurate results of operations for the previous month.

A complete detailed financial report is presented monthly to the officers of the company. In addition, a separate report in condensed form is prepared for submission to the board of directors at its monthly meeting.

The detailed monthly financial report rendered to the officers includes the following statements:

- Balance sheet (Fig. 2).
- Statement of inventories.
- Statement of changes in plant property accounts for the month and year to date.
- Statement of changes in reserves for depreciation and obsolescence for the month and year to date.
- Statement of changes in other reserves for the month and year to date.
- Statement of surplus accounts.
- Statement of income for the month and year to date (Fig. 2).
- Statement of sales, cost of goods sold, and gross profit, by divisions, for the month and year to date.
- Detail of selling, administrative and general expenses, income credits and charges, for the month and year to date.
- Detail statement of sales and gross profit, by products for the month and year to date.
- Statement of cost variances for the month and year to date.
- Supplemental profit and loss information for the month and year to date (Fig. 2).

Periodically during the year a statement of cost of goods sold showing the prime elements of cost is prepared and included in the foregoing detailed report.

The condensed financial report to the board of directors includes the following statements:

- Balance sheets as of the close of the month and statements of income for the month and year to date. Separate statements are prepared for the parent company, each of the subsidiary companies, and for the consolidated companies.
- Statement of net sales and net income for the month and year to date, and for the same periods for the four previous years.
- Estimated cash position for the American Companies, by months, for the coming year (Fig. 3).

All the forms for our financial reports are printed, which is in accordance with our policy of presenting

ESTIMATED CASH POSITION- JANUARY 1, 1938 TO DECEMBER 31, 1938

MONTH	CASH AND SECURITIES BALANCE BEGINNING OF MONTH	SOURCES			TOTAL	DISBURSEMENTS					CASH AND SECURITIES BALANCE AT END OF MONTH
		ESTIMATED EARNINGS	DEPRECIATION PROVISION	OTHER PROVISIONS NOT REQUIRING CASH OUTLAY		ESTIMATED CONSTRUCTION EXPENDITURES	ESTIMATED ADDITIONAL WORKING CAPITAL REQUIREMENTS	DIVIDENDS	LIQUIDATION OF LIABILITIES AND RESERVES	TOTAL DISBURSEMENTS	
DECEMBER 1937 ACTUAL											
1938											
JANUARY											
FEBRUARY											
MARCH											
APRIL											
MAY											
JUNE											
JULY											
AUGUST											
SEPTEMBER											
OCTOBER											
NOVEMBER											
DECEMBER											
TOTAL											

NOTES:

Fig. 3—Statement of estimated cash position by months for one year in advance. Included in condensed report to board of directors

information to the management in a clear and concise manner. It may be of interest to those readers of this article who are accountants, to know that practically all information required in the Annual Report (Form 10–K) of corporations filed with the Securities and Exchange Commission and the New York Stock Exchange is readily available in these reports.

In addition to the financial statements mentioned, the detailed monthly report to officers contains a section devoted to comments written by the comptroller. An attempt is made to present in these comments all pertinent facts relative to the operations of the company as shown in the statements and to bring to the attention of the officers matters which require their consideration. Included are data on increase or decrease of sales and cost of sales, detailed explanations of cost variances, explanations of differences between actual and budgeted selling, administrative, and research expenses, and observations relating to balance sheet items. The accounting department also prepares reports based on special investigations made from time to time relating to matters which are considered to be of administrative value to executive officers.

The president of the company presents annually to stockholders a comprehensive report of the activities of the company during the fiscal year. Included in this report are audited financial statements. Also, unaudited financial statements are presented quarterly to stockholders.

Machine Accounting at Monsanto

An interesting section of Monsanto's accounting department is that known as the Tabulating Accounting Division. Many of our accounting records and most of our statistical data are prepared on these machines, which produce alphabetic as well as numeric records. Some of the work done in the machine division is as follows:

Plant Property Accounts. The plant property accounting records include a punched card for each item of equipment in the various plants. These cards include all necessary information relative to asset values and reserve for depreciation. Periodic tabulations are made of asset values and a monthly tabulation is made for the purpose of obtaining the amount of depreciation provision to be charged to operations.

Distribution of Vouchers Payable. This application of the tabulating machines involves the punching of cards for the distribution of vouchers payable and the monthly tabulation of these cards from which postings are made to the various ledger accounts.

Preparation of Sales Invoices. The preparation of sales invoices on the tabulating machines is a recent development with us. Briefly, the plan contemplates the use of prepunched cards, and as orders from customers are received, cards covering the products ordered, customer's name and address, and special instructions, are removed from the files. After inserting on the product cards the quantities ordered, the cards are tabulated on shipping order forms which are sent to the plant. In many instances, weights and other information are not available until after the order is filled. Upon receipt of shipping information from the plant, sales prices and weights are punched in the product cards, and the cards are then extended by the automatic multiplying punch. After this operation the cards are listed on sales invoices, and at the same time, by means of summary punching, accounts receivable debit cards are automatically obtained. Also, from these product cards and certain sales master cards, the sales analysis cards are automatically prepared.

Accounts Receivable Records. This application is closely allied with the preparation of sales invoices described above. Accounts receivable debit cards, which are obtained automatically at the time of preparation of the sales invoices, are filed in the accounts receivable file. When invoices are paid, debit cards representing these invoices are removed from the receivable file. Partial payments and sundry charges and credits to the customers' accounts are handled in a similar manner. After all charges and credits for the period have been applied to the customers' accounts, a trial balance is obtained by listing the file of cards. Customers' statements are prepared from these same cards and periodically the ageing of the accounts is also obtained therefrom.

The prompt and complete information obtained as a result of this system is very helpful in the collection of receivables.

Sales Analysis. As related in a previous paragraph, sales analysis cards are automatically obtained. Various tabulations are prepared from these for accounting and statistical purposes.

Payroll Records. Tabulating machines are also used in the preparation of payroll records for certain of our plants. This work includes payroll listing, distribution of payrolls and accumulation of data for income tax and Social Security purposes.

Machine accounting has a place in modern business. It is the means by which a great mass of detail can be readily accumulated and summarized. The records obtained from tabulating machines are complete and orderly.

Where and How to Get New Funds For Plant Expansion

By F. EBERSTADT

PRESIDENT, F. EBERSTADT & CO., INC.
NEW YORK, N. Y.

Graduated from Princeton in 1913 and the Columbia Law School in 1917, Mr. Eberstadt served his country on the Mexican Border and thereafter with the A.E.F. in France. Returning in 1919 he was admitted to the Bar and took up practice with the firm of McAdoo, Cotton & Franklin, becoming a partner in 1923. Then in 1925 he became a partner in the investment banking firm of Dillon, Read & Co. This position he relinquished in 1929 to go abroad as assistant to Owen D. Young at the Reparations Conference. In August 1931 he formed the firm of F. Eberstadt & Co., Inc., which has since had a prominent role in investment banking. During the past year it successfully underwrote the public offering of 150,000 shares of Victor Chemical Works, a substantial part of the proceeds of which are being used in plant expansion

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HERETOFORE most chemical companies have found it both possible and advisable to provide for a large portion of the cost of plant expansion out of earnings. Under present tax laws, however, with their severe penalties on undistributed profits, expansion out of earnings has become extremely costly, with the result that in many cases it seems advantageous to obtain such funds through public financing.

Fortunately for the chemical industry, it is better situated to approach the public investment market than most other industries. This industry as a whole has shown such substantial growth over the past years and its future is regarded as being so bright, that securities of well established companies in this field are highly regarded by investors and sell at prices generally higher in relation to current earnings and dividend return than in the case of most other industries. Only recently Roger W. Babson has nominated the chemical business for "The Industry of 1938," mentioning particularly the favorable relation of the chemical industry to the labor and inflation problems that are causing considerable concern to investors.

Time to Finance

There are, among others, four major elements to be considered in connection with financing: the time to finance, type of security to be issued, cost of the money, and source from which the funds are to be obtained.

Generally speaking, the ideal time to finance is when earnings are good and market conditions favorable, but, like most other ideal situations, the conjunction of these two conditions is rarely perfect and experience has shown that it is probably unwise to attempt to pick the top. The late Collis P. Huntington is alleged to have responded to the inquiry of a friend as to the best time to finance, that the very best time to do so was "when you can." Necessarily the terms and conditions must be weighed with relation to the possible return to the corporation from use of the funds, and, in finance, as in most other business matters, the best market condition is often missed by those who delay unduly. At any rate, there is no record of any company going into the bankruptcy courts from timely financing even though the company failed to gage the top.

Type of Security to Issue

Funds put into plant become permanently invested as distinguished from funds to finance increasing business which go into inventory or receivables. In case of recession, the latter can be converted relatively quickly into cash and the indebtedness incurred liquidated. Thus, short or medium term bank borrowings, commercial paper, etc., are proper vehicles for obtaining funds for current working capital. Investments in plant, however, can be repaid but slowly out of profits resulting from use. Accordingly, the primary requisite for financing plant expansion is to do so in a manner which permits repayment over a sufficient period of time to allow the investment to earn its way out. Records of the bankruptcy courts contain many examples of companies which have attempted to finance permanent additions through temporary funds. Financial history has proven that the best method for obtaining funds for plant expansion is through the sale of stock, although in the case of companies in strong financial position with a stable record of earnings, the issue of long term obligations is permissible.

There are, of course, a great variety of types and provisions which can be incorporated into securities, but, generally speaking, securities fall into four classes: common stock, which is an unlimited *pro rata* share in the earnings and net assets of the corporation; preferred stock, which is a claim prior to the common stock on the earnings and assets of the corporation but with specified limitations; unsecured debentures; and mortgage or other secured bonds.

Frequently the attractiveness of preferred stock, debentures, or bonds, is enhanced by the advantages of rights of conversion into common stock, or accompanying warrants offering common stock purchase privileges. The corporation need not necessarily confine itself in any instance to one of these vehicles. In determining the particular type of security to be issued, consideration

must also be given to the company's existing capital structure and the feasibility of making changes, purpose of the financing, condition of the security market, and numerous other special factors.

The character or type of security best suited to the needs of a particular company can only be determined by study of all of the factors involved. Issuance of fixed interest securities, that is, debentures or bonds, may be indicated in the event that the physical properties give adequately tangible security, with earnings over a period of years sufficient to provide a conservative margin over the amount required to defray interest and amortization. This form of financing frequently involves the least initial money cost to the borrowing company, although under existing tax laws, amortization of debt out of earnings is very expensive.

Preferred stock has many important advantages. It has no compulsory repayment date and if, due to unforeseen circumstances, dividends have to be temporarily passed, the consequences are not so serious as in the case of default on bond interest or maturities. To compensate for this less favorable position, preferred stock ordinarily carries a dividend rate somewhat higher than the interest that would be paid on a corresponding bond issue.

It is significant, however, that a large part of the public financing of chemical companies done in recent years has been through the medium of common stock. This, generally speaking, gives the company more latitude than can be found in any other type of financing. Of course, in determining the appropriate type of security, the condition and demands of the market at the moment are of primary importance, as financial markets, like many others, have a definite style factor and at certain times buyers prefer and will pay more for particular types of securities.

Cost and Source of Funds

As to terms and cost of contemplated financing, it is impossible to give figures which would apply generally. This depends on the character, history, outlook, etc., of the company in question and the particular field of the industry, as well as upon market conditions. Each issue is, so to speak, a custom made job and contains certain elements which distinguish it from practically every other issue so that determination of price and terms in a manner that would be possible with more stable or classified products is out of the question.

So far as terms are concerned, the chemical industry is very favorably situated at the moment, perhaps more favorably than most others, as its securities enjoy a relatively greater acceptance in the market with a correspondingly higher price than most other fields. To express this in dollars and cents is, of course, impossible in a general way. New securities are sold largely on a basis of comparison with similar ones now outstanding, and the price for any particular issue must be gaged by the price of other companies of like size, record, financial position, and outlook. Under the present practice whereby the prospectuses of public issues contain a full disclosure, it is not difficult for the management to ascertain, within reasonable limits, the proper cost of financing to the company and reasonably comparative terms.

Generally speaking, the savings of the investing public constitute the source from which such funds are obtained. Occasionally the management of the company is in touch with individuals of means who welcome an opportunity to purchase securities of the company in question. This is the exception. Often it is deemed desirable before offering securities to the public generally, to afford the existing shareholders an opportunity to subscribe for the new securities, and occasionally this is done without underwriting, but more frequently managements adopt the conservative course of arranging with an investment banking firm to underwrite the sale of the securities in question so they may be assured of obtaining the funds.

Effect of Securities Act

Public issues of securities, with certain very minor exceptions, must now be made pursuant to the Securities Act of 1933. This puts on the issuing company the obligation of registering the securities. While the task involves considerable time and effort, on the whole the bite is not as bad as the bark and there is no reason why a sound company with a good record should be deterred from public financing because of the necessity of registration. The important point in this connection is the selection, in addition to a qualified investment banking house, of lawyers and accountants cognizant of the usages and practices of the Securities and Exchange Commission.

Registration usually requires from 30 to 60 days, involving the preparation of a registration statement with pertinent financial exhibits, prospectus, etc. This must remain on file with the Commission for a period of 20 days before the securities in question can be publicly offered, but in spite of the work, expense, and time involved, the difficulties of registration have been greatly exaggerated as is witnessed by the great numbr of successful issues which have been carried out under the new laws.

In connection with public issues, frequently the question of listing on one of the national exchanges comes up. This does not involve a serious burden either of time, work or expense. In many cases it carries the advantage of liquidity because, having obtained a recognized market, the corporation's securities have, in effect, a currency value.

There is also very considerable advertising value involved in a public issue and in the listing on one of the big exchanges. From the point of view of the stockholders individually, such listing usually increases the liquidity and market and collateral value of their holdings. Many banks are now inclined to confine loans to listed securities. Then, too, a listed price reflects capitalized earnings as contrasted with current income.

The sale of securities publicly, particularly when undertaken by a company for the first time, deserves, of course, most careful consideration. And while it has been the intention of the author to outline a number of the more important factors involved, naturally in so limited a space there are a great many considerations which must necessarily have been omitted. Although the decision is important and needs careful consideration, the frequency and success with which public financing has been consummated is evidence that no sound company need hesitate to avail itself of this method of raising funds.

FACTORS IN CHEMICAL COSTS

What the Transportation Department Reports

By JAMES G. LYNE
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The author has been closely connected with the railroad industry all his life. His father was a railroad man, and he grew up in a railroad town in Kansas. For several years, before and during his attendance at the University of Kansas, he worked in a variety of railroad jobs. His particular field of interest at present is transportation economics of which he has long been a student.

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TRANSPORTATION is a plant facility of the chemical industry. The customer interest in the product is in it laid down where he wants it—not in the plant of the manufacturer. Hence the quality and cost of transportation are ingredients inseparable from the product, in the eyes of the consumer. The industry has thus an immediate concern in the economical operation and continued improvement of this essential service despite the fact that the job is, for the most part, "farmed out," so to speak, to contractors rather than performed by the industry itself. Conditions which affect the transportation "contractors," bearing upon the efficiency and economy of their service, or which may influence progress in transportation for the future, are just as proper a concern of the chemical industry as if it were considering the status of an essential department within the industry.

So far, improvement in transportation has paralleled increasing efficiency in other departments of the chemical industry. In many respects railway service has made rapid progress in the last 10-year period. Also, spectacular improvement is occurring right along in the serviceability and economy of all kinds of automotive equipment—an improvement which is paralleled by the increase in heavy-duty highways. The design of marine equipment and the extension of the country's waterways likewise continue to go forward.

On the basis of this and other evidence, it appears the "transportation department" of the chemical industry is competent and, so far, that it has done a good job. But what does the future promise? In the opinion of this reporter, there is evidence to support a belief that further progress in transportation economy may be nearing a period of stalemate. Since such a development would be as serious in its effects upon the chemical industry as if one of its own departments—production or sales or engineering—were suddenly to lose its ability to progress, a brief consideration of some of the conditions which seem to threaten future progress in transportation may be time well spent.

It has been disclosed (*Chem. & Met.* vol. 44, Sept. 1937, pt. II) that 77 per cent of inbound shipments of the chemical industry and 82 per cent outbound still move by rail, despite the great increase which has occurred in recent years in the development of highway and waterway transportation. Clearly, therefore, to say that conditions exist which threaten to impair the continued efficiency and economy of railway service, is equivalent to a declaration that those conditions are endangering more than three-fourths of the transportation department of the chemical industry. That statement must be made.

The fundamental condition which is serious in transportation is the definite loss of profitability of capital invested in railway plant. The accompanying chart indicates clearly the seriousness of this condition. During the 7-year period prior to the great depression, the railroads earned between 4 and 5 per cent on their investment. Then for 5 years the return was 2 per cent or less. In 1936 there was recovery to 2.6 per cent, and in March, 1937, to almost 3½ per cent. Since then, the decline has been catastrophic—earnings of the rail carriers in recent months having dropped almost to the lows of the depth of the last depression.

This decline in the profitability of investment in railways has resulted in the decline of volume of investment in them. (In the 10 years ended with 1931, total investment in railroads increased by more than $5,000,000,000; in the 5 years ending with 1936 total investment decreased by almost $500,000,000). Since new capital investment is the source of most increases in efficiency and improvement of service, it follows that, unless the causes of unprofitability of investment in railways can be removed, the chemical industry cannot in future expect the quality performance of the "three-fourths of its transportation department" that it has had in the past. Moreover, the railways are one of industry's largest customers, as well as its servants; and impoverished customers cannot make money for anyone with things to sell.

In the accepted nature of things, private business has no right to call public attention to its troubles, seeking outside assistance to remove them. In the case of the railroads, however, the difficulties which they face have arisen outside the industry, and, hence, cannot be overcome by purely internal measures. All major railroad difficulties, although they assume a variety of forms, are fundamentally identical in nature, to wit, they arise from governmental intervention to modify or thwart normal economic processes. Three of the most important of them are the following:

1. Regulatory policy has refused to permit rate levels to conform with price levels in other industry.

2. Labor costs are encroaching more and more upon net earnings, enforced by a legally-protected unionism which, so far, has recognized no responsibility for reasonable net earnings to its employers.

3. Competition from socialized or partially-socialized transportation agencies is constantly increasing.

The railroads' situation is to some degree similar to that of the utilities in meeting the T.V.A. type of competition. There is this distinction, however, between government money competing with private capital in the power field and in transportation. In power, government projects do charge *something* for the power they generate in competition with the utilities; and the same is true in the case of highway facilities. By contrast, the water transportation facilities which are created by power and navigation projects are absolutely free of tolls.

If industry, and the chemical industry in particular, wishes to maintain the continued improvement which the privately-owned three-fourths of its "transportation department" has provided in the past, attention to the conditions which are threatening such maintenance are obviously as legitimate a concern of the industry as any part of its own internal workings.

It is utterly unrealistic to expect that the railways, whatever technical and commercial genius they may command, can continue to earn a return sufficient to attract new capital, and that they can continue to improve and cheapen their service, unless somewhere a limit is placed upon the amount of highway and waterway plant the government is going to build and turn over to commercial use, at less than a commercially-determined charge for the enormous facilities thus provided.

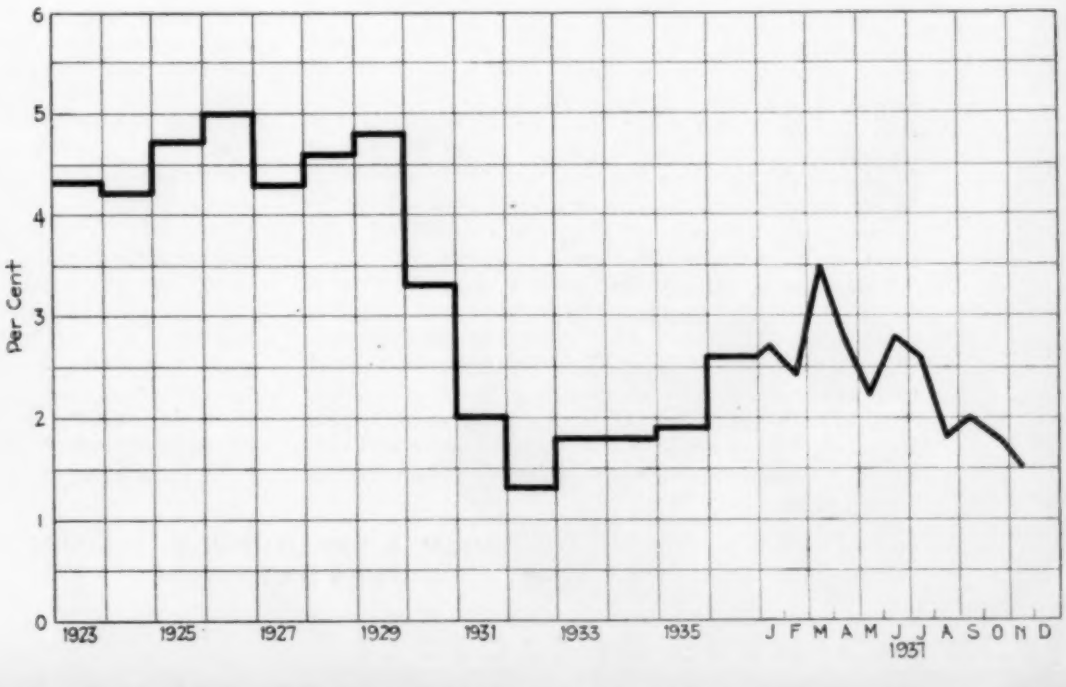
The railways are seeking an increase in freight rates which, with increases recently allowed, will average about 15 per cent. The effect of such an increase on the chemical industry, if granted would vary, of course, depending upon the percentage of the total price of the product which transportation charges represent. For commodities in general, the I.C.C. has calculated that freight charges in 1936 were 8½ per cent of the destination value of freight shipped by rail. An increase in freight rates of 15 per cent would increase delivered cost of the average shipment to the consignee by only a little more than 1 per cent—scarcely sufficient to discourage sales.

It is true, of course, that most shipments are not "average." The percentage increase in price at destination which a 15 per cent freight rate increase would indicate (based on 1936 prices and freight rates) would be as follows for a few of the commodities of interest to the chemical industry:

Refined petroleum and gasoline	1.8
Cottonseed oil	0.5
Turpentine	1.4
Pulp wood	4.8
Crude rubber	0.3
Bituminous coal	8.4
Asphalt	3.5
Sulphur	1.5
Alcohol, denatured	1.0
Newsprint	3.3
Explosives	0.6
Fertilizers	1.9
Sulphuric acid	2.0
Soap	0.6

Industry must choose. Does it want to save pennies immediately in lower transport *expenses* (not true costs) by diverting more and more of its high-valued traffic to transport agencies paid for, in some part at least, by taxation—and later on pay for these supposed savings by higher freight charges on raw materials, and higher taxes? Or is the desire for lower cost and more efficient transport, considered as a whole, and including raw materials as well as finished products?

There is no indication as yet that industrial leaders have in large numbers awakened to this second approach as the wiser one in dealing with their transport problems. Perhaps the reason for this failure is that, so far, transportation policies have not been weighed by the executives responsible for the health of the business as a whole, but have been relegated to specialists—the industrial traffic managers. And perhaps the performance of traffic managers has been too often gaged—not by their qualities of statesmanship in assuring economical transportation over a term of years, but by a rule-of-thumb measure of their ability to whittle down immediate transportation expenses.



Rate of return earned on railway investment, years 1923-36 and 1937 by months

HIGHER LABOR

By FRANK RISING
MANAGEMENT AND LABOR EDITOR
OF *Business Week*
NEW YORK, N. Y.

After graduating from the University of Kansas, the author spent several years as a lumber mill hand in the Northwest, construction crew worker, farm hand and factory worker in the Mid-West and South before turning to journalism. He is a veteran reporter who does his own investigating, visiting the scenes of strike and labor disputes in person. His accurate forecasts of events in the "new labor movement" have attracted considerable attention.

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"PUTTING the labor problem into a nutshell" is something that can't be done, by chemical industry or any other business. There are, however, certain conclusions which can be made at the present time, and which bear on the problems of cost accounting, production planning, and the general business outlook for 1938. In these general conclusions, and in development of several specific angles, the chemical manufacturer may find a worthwhile course of study.

Fortunately, the business recession, despite its headaches, offers a "breathing spell" from labor union advances and demands for more wages and shorter hours. And as long as the slump lasts the organizers will be playing checkers in their dugouts, waiting for the call to go over the top when increased profits are announced. In the meantime the business manager, also waiting for recovery, will take account of several fundamental labor trends as he estimates his future prospects.

These trends indicate that when a normal course of business recovery resumes, higher labor costs must be faced either directly or indirectly by most manufacturers. That these increases can come in some shop from which he buys materials, or in his own shop, nearly every business man realizes. Some of the increases can of course be balanced by increased production and lower unit cost, or by increased efficiency, or by higher prices, but the prospect of "more demands for more" from labor have to be faced. The average policy-maker and research worker in the big unions figures that the approximate pay increases expected by labor will be about 10 per cent if business gets back to the standards of the first half of 1937.

Roughly, all wage and salary workers can be divided into four classes: the unskilled manual laborer, the skilled worker with machine or tool, the white-collar employee with a fair amount of education and training, and the higher ranks of white-collar workers usually called "professional" people. It is evident at a glance that certain industries find the bulk of their workers in the lower classes, and that other businesses employ a greater proportion of highly-skilled people. It is evident, too, that the unionizing drives of the past two years have gone furthest in the lower-paid ranks of factory workers, which might at first conjecture seem to put the relatively high-skilled chemical worker in a safe preserve. But more detailed examination is needed.

A noticeable trend thus far, and one which can be expected to continue any time the business recession yields to a more normal course, is toward both shops and white-collar employee organization and collective bargaining, which in the great majority of cases is proceeding by stages. Generally speaking, these are the steps: 1. Organization of hitherto unorganized employees into A.F.L., C.I.O., or independent unions. Demand for collective bargaining status. 2. Demand for higher wages, shorter hours, and privileges of seniority, shop steward systems, better working conditions, and so on. The shop which follows a policy of chiselling the wage scale below industry's average, and particularly below the local average for the same work, will face the greater proportional forced rise in labor costs and must weight the labor problem more heavily in 1938 plans. 3. After initial union contracts have run out—and some are running out at present—the labor groups are inclined to ask that emphasis be taken off hourly rates and put on annual guarantees. In other words, the next step is toward salary forms instead of piece-work plans in many industries which suffer from peaks and valleys of production even during normal years.

Of these steps, the average employer during the coming year need pay close attention only to the first two, the third will not be mentioned in a general drive for some time to come. But the policy which fits closely the advancing trend toward socialization and democratization in industry must admit certain clearly evident developments which seem likely to stay with us.

In the first place, collective bargaining and unioniza-

COSTS Are Coming

tion are popular devices, which is to say that the votes are behind them. The wide-open shop will not turn into the tightly-closed shop in many places, but it is quite likely to become a preferential shop.

In the second place, organization of white-collar and professional workers is preparing for a long run under the direction of several agencies. It presents a multitude of problems not only for the employer of such help but for the help and union organizers themselves. In this connection, the chemical industry might well be thinking of its highly-skilled employees, and trying to find a common ground of compromise for the following problems: 1. White-collar employed workers have in many places felt themselves "caught in the middle" between an organized body of wage-and-hour labor and an organized employer force. 2. A large number of well-educated workers have been unemployed and on the relief rolls for some time. 3. Several campaigns to organize both of the above classes have developed and are making headway.

As far as the law is concerned, under the Wagner Act as interpreted by the National Labor Relations Board, technicians, engineers, draftsmen, research people, and such highly-skilled workers are employees just as much as any laborer, no matter how the employer may feel about the "professional" character of the job. In the case of the Chrysler Corp. and the Society of Designing Engineers this was clearly set forth; the Board held that although it was true that the work performed required a high amount of skill and imagination, the engineers were "in no sense executives," and had "need of organized strength in common with all wage earners."

Further decisions developed the rule that an employer or executive is distinguished from an employee by the right to hire or fire. If an employee is below this position, he can organize and bargain collectively through any agent he chooses, under a national code which the great majority of informed observers foresee as a permanent part of the future industrial relations fabric.

Even before these decisions had been made, and while the great rush to unionize was on in 1937, white-collar workers began to flock to the banners of both A.F.L. and C.I.O. At first this trend was noticeable only in the ranks of retail clerks of stores which adhered pretty closely to sweatshop standards. Then it spread into office workers, and into so-called "professional" groups which, with the exception of the Newspaper Guild of editorial workers, had been untouched.

As things stand today, the A.F.L. with its Federation of Technical Engineers, Architects, and Draftsmen, and the C.I.O. with the Federation of Architects, Engineers, Chemists and Technicians, are eyeing the unorganized personnel in industrial plants which has not been assigned to some other affiliate as sales territory. Usual procedure is to follow the shop organizers into a plant where an agreement has been won for the rank-and-file, and begin to talk it over with the technical men.

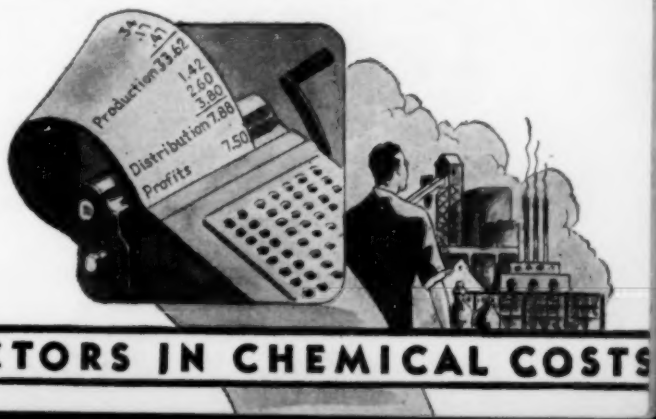
Offhand, it might be thought that professional pride, individuality, and the tendency of technical people to disregard long hours and onerous conditions in the hope of ultimate good position, might hamper such organization. It does—but there are several classes of technically-trained people who will accept a chance to join a union today where they might not have a few years ago.

As might be expected, the organizing efforts of I.F.T.E.A.D. and its rival, F.A.E.C.T., have made most progress among the unemployed. F.A.E.C.T., as a matter of fact, built its membership principally from among relief-roll and W.P.A. people during the four years it was an independent before it joined the C.I.O. Today it is very strong among technically-trained workers in the W.P.A. forces, particularly in New York City. Its leaders are smart, thoroughly conversant with their field, and indefatigable in their efforts to strengthen their union in private industry.

Other unions have special sections working on white-collar unionization, with the United Mine Workers particularly interested in chemical employees. In the main, information and research is pooled from time to time, and policy-making is coordinated. It was at the suggestion of a U.M.W. guest that the F.A.E.C.T. started work on a new angle following its latest convention; the angle is organization of college students before graduation, if possible, so that industrial fields may be "colonized" with recruits already sympathetic to unionization.

There's a "radical fringe" in the white-collar unions, as in all unions today, and the leftists are somewhat socialistic or communistic in political views. But there is little violence or passionate prejudice evident, and observers don't count the radical element as much of a "menace." But it is important as a piece of the picture, and as part of the general leftward swing in national politics.

Summing up the situation, these are the things to be looked for: 1. Piece-work labor is likely to be organized rapidly by outsiders or to organize itself independently, with a business upswing. 2. White-collar labor is disaffected in part, but if basic causes for dissatisfaction or fear of unemployment were removed the upper branches would be quite reluctant to join any movement. The employer can make good use of reason, tact, and patience in talking things over any time he gets a chance to, with all the salaried workers in his plant. 3. The business recession will hold off union drives as long as it lasts, *but* when they resume it is likely that A.F.L. and C.I.O. will be joined, which will make it tougher. 4. In any event, increased costs of labor must be expected generally, and should figure in future planning.

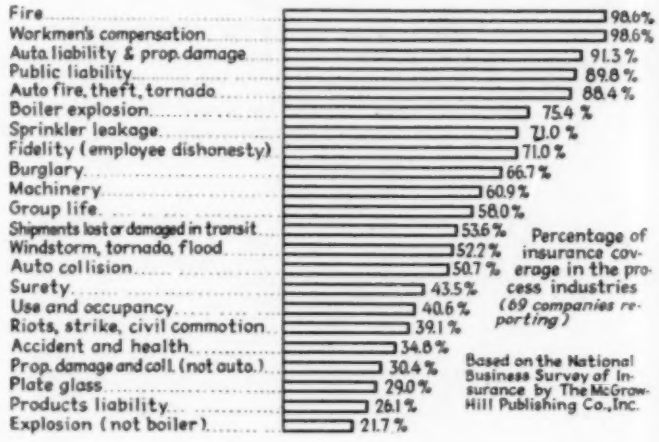


FACTORS IN CHEMICAL COSTS

Insurance Provides Industry's Factor of Safety

By REUEL C. STRATTON
SUPERVISING CHEMICAL ENGINEER
THE TRAVELERS INSURANCE COMPANIES
HARTFORD, CONN.

Immediately after his graduation from Trinity College in 1915, Mr. Stratton was employed as a chemist by the Scovill Mfg. Co., Waterbury, Conn., and later by the New Departure Mfg. Co. at Bristol, Conn. In 1919 he became affiliated with The Travelers Insurance Co. at Hartford, as a chemical engineer. In 1926 he was made Supervising Chemical Engineer in charge of the chemical engineering unit and laboratories, a title which he still holds. His experience has been chiefly in design of high pressure and special type chemical engineering equipment and studies of plant hazards, accident prevention, occupational disease, and allied subjects


Fire 98.6%
Workmen's compensation 98.6%
Auto liability & prop. damage 91.3%
Public liability 89.8%
Auto fire, theft, tornado 88.4%
Boiler explosion 75.4%
Sprinkler leakage 71.0%
Fidelity (employee dishonesty) 71.0%
Burglary 66.7%
Machinery 60.9%
Group life 58.0%
Shipments lost or damaged in transit 53.6%
Windstorm, tornado, flood 52.2%
Auto collision 50.7%
Surety 43.5%
Use and occupancy 40.6%
Riots, strike, civil commotion 39.1%
Accident and health 34.8%
Prop. damage and coll. (not auto.) 30.4%
Plate glass 29.0%
Products liability 26.1%
Explosion (not boiler) 21.7%
Percentage of insurance coverage in the process industries (69 companies reporting)
Based on the National Business Survey of Insurance by The McGraw-Hill Publishing Co., Inc.

AN INDUSTRY is not secure unless it is well fortified against all risks that may produce severe financial loss. Progressive manufacturers realize this and automatically consider and provide protective measures during the early stages in the development of any process or business. No engineer would design pressure equipment, a building, or in fact, any pertinent piece of apparatus without working into that design a suitable factor of safety to protect against predictable hazards. Similarly insurance may be regarded as a safety factor to cover those multitudinous risks which attach to every sort of human enterprise, ranging from the unavoidable to those assumed only by choice. It is an economic procedure by which the insurer may protect his investment, at a predetermined cost, by providing for indemnification in case of loss or the reparation of injury. For industry, as well as the individual, insurance provides both stability and security.

Most chemical engineers are familiar, at least in a general way, with the more important types of business insurance. But this familiarity is usually confined to a relatively few lines and often lacks appreciation of the wider field of profit protection which is available through the medium of insurance. A national insurance survey recently completed by the McGraw-Hill Publishing Co., shows industry to be fairly cognizant of the need of certain special types of coverage, but the same survey also reveals that there are large percentages of plants that are still gambling against unfortunate incidents which may prove extremely expensive, if not ruinous.

Insurance, through reduction of risk of loss, lowers costs and stabilizes production. In any chemical-making plant the usual risks or exposures to risks, fall into three insurance groups or classifications: viz., plant and equipment, personnel and manufactured products. Each has certain recognized hazards, yet each requires many additional forms of protection not always appreciated.

The need for fire insurance is universally recognized, for example, but few engineers appreciate the additional types of protection which are available to offset losses not attributable directly to fire. The more important of these are: consequential loss, windstorms, earthquake, rent and rental value, leasehold, profits and commission, riot and civil commotion, explosion, and sprinkler leakage. As the average industrialist is more familiar with fire coverage than with other lines of protection, these types are suggested by name only. Every chemical plant requires certain of these forms of coverage, although it must be admitted that not all obtain this protection.

Various forms of casualty and indemnity insurance are required in chemical manufacture. Boiler coverage providing indemnity for loss or damage due to explosion, collapse or rupture of steam vessels, and unfired pressure vessels such as tanks, autoclaves, and process chambers, should be included. "Use and occupancy" protects against loss by part-time production. Machinery insurance, including engines and turbines, if taken together with use and occupancy, consequential loss and outage will protect against destruction of profits or capital structure. Such types are designed to protect primarily against

catastrophe, or against loss of production due to failure of the specific unit covered. All may be written in varied forms, each covering to a different degree.

So-called liability protection is designed to indemnify the purchaser of insurance against consequences of negligent acts resulting in injury to a third party for which he may be legally liable. Such coverage may even be extended to cover assumed liability. In contrast with direct loss of, or damage to, property, a liability claim may obligate the party held responsible to make payment for years in the future. Liability insurance should not be confused with accident insurance. It merely defends the purchaser against claims and if he is found legally liable for the loss, settles the claim according to the due obligation under the liability imposed by law.

A chemical company may be liable for the safety of non-employed persons visiting its property for the transaction of business. It may be liable for the acts of its employees while away from the plant property, and it may also be liable for property damage claims wherein material emanating from a chemical process produces damage upon the persons or properties of persons outside of the legal limits of the plant. Property damage is not usually covered under a liability policy unless so specifically insured.

Protecting and Insuring Personnel

The personnel of a chemical plant requires several types of insurance coverage. Employer's liability, an outgrowth of common law, has been superseded in most states by workmen's compensation laws. In general, such legislation disregards any theory involving negligence and is based on the idea that the cost of accidents to employees is a part of the normal cost of production—to be borne by a proportionate increase in the selling price of the material manufactured. Compensation legislation fixes, with as much detail as possible, the exact benefits which may be applied for each specific type of injury, although allowing certain variations. The present-day tendency to liberalize compensation acts has extended those of certain states to include occupational disease hazards under the existing law. Workmen's compensation insurance, including occupational disease, is by far the most important protection demanded by a chemical industry. Employer's liability is still necessary in a few states or it is occasionally used by an employer to protect himself in a few exposures which may not necessarily come within the scope of existing laws.

Certain other forms of insurance tend to promote more harmonious relations between employer and employees. Others indemnify against loss created through the decease of executives, research heads, and other key men. Business life insurance is important as well as business accident coverage. Employees have benefited through the wise provision of the group lines of insurance such as ordinary group life, group accident and sickness, pensions, and salary allotment life. The last named provides means whereby an employee may secure coverage through monthly deductions from his salary.

The liability of a chemical manufacturer extends beyond the time his product leaves his manufacturing establishment. Producers of chemicals may be held for negligence in cases where the product manufactured, handled or distributed may have caused injury to persons of the public in connection with the consumption, handling, or use away from the producers' or agents' premises. No matter how carefully an article may be manufactured, packaged and distributed, there is always the possibility that the maker may be involved in damage suits alleging negligence on the part of employees during its production. Insurance for this hazard is important and may be obtained to cover most manufactured articles.

Products public liability indemnifies against claims for injuries but does not assume liability for damage to property unless such coverage is specifically written into the policy. Chemical and food manufacturers can cite many examples of the importance of this type of coverage. Claims may be bona fide or fictitious but sometimes even the defense alone may involve costs that would bankrupt a small company.

Transportation of products to consumers involves insurance. Automobile liability and property damage together with fire, theft, windstorm, plate glass and collision coverages are available, collectively or individually. Operating under present traffic conditions, no chemical manufacturer can afford to have company trucks or cars enter upon public highways without this protection. When employees are permitted to drive their individually owned automobiles for business purposes, non-ownership liability insurance becomes essential to protect the employer against claims for bodily injuries or property damage arising out of the use of such vehicles.

The cost of the insurance required to protect a chemical plant should be distributed as operating expense. With few exceptions, premium charges are paid to insure continuity of production or to indemnify against loss created through unfortunate occurrences during production. In general, these are fixed annual charges. The amount may be a guaranteed charge for a specific limit of protection or it may be a percentage levied on the payroll exposed or on the total volume of business done. In each instance it still remains a fixed manufacturing charge and can be allocated against cost of production.

The average chemical manufacturer is not equipped to survey his exposures and determine his insurance needs. The arrangement of a proper insurance program to fit the individual needs of chemical manufacturing is usually the work of a technical expert. An insurance adviser, agent or broker, should be selected with the same sort of discrimination which a chemical manufacturer would exercise in making a selection for his scientific and technical staff. A survey of insurance requirements may suggest certain portions of the risk as over-emphasized and others weak and improperly provided with the required protection. Surveys are not limited in value to large corporations.

Complete protection is essential. While the actual loss is paid by the insuring company, hidden factors creep in, the real cost of which no manufacturer can accurately estimate. It must be realized that the accumulative prevention of losses will provide the ultimate amount of protection at the lowest net cost. Insurance is an integral part of any chemical plant program and is definitely a factor in production costs.

FACTORS IN CHEMICAL COST

IS NOW THE TIME TO BUILD?

By H. W. RICHARDSON
ASSOCIATE EDITOR OF *ENGINEERING NEWS-RECORD*, NEW YORK, N. Y.

After graduating from the civil engineering department of the University of Colorado, the author joined the Bates & Rogers Construction Co. of Chicago, Ill. He served this organization as engineer and superintendent on the construction of bridges, dams, power plants, industrial buildings, etc., in all parts of the country for several years. In 1928, Mr. Richardson turned to editorial work. His duties require extensive traveling and considerable field work, visiting projects under construction, interviewing contractors, engineers and designers of industrial works; contact with labor, material and equipment interests.

THE BRIGHT OUTLOOK for the near future in expansion of industrial plant is supported by new productive capital figures of the past year. Corporate issues of this class in 1937 totalled more than $500,000,000, more than double those of the previous year. Much of this money is still to be spent.

But industry is probably more concerned with the cost of building than it is with the amount of construction for which it is responsible. The *Engineering News-Record* cost index of all construction averaged 15 per cent higher in 1937 than in 1936. Compiled from certain materials prices and labor rates, and based on 1913 as 100, the index rose from 223.45 in January to 244.95 in December, averaging 236.41 for the year; the 1936 average was 206.41. The index is now at the highest level since early 1921, during the post-War boom.

However, perhaps a better indicator of costs of industrial buildings alone is the Aberthaw Construction Co. index, based on reconstruction costs of an actual factory building erected in 1914. This index averaged 198 for 1937, an increase of only 10 per cent over 1936. Furthermore, this index shows a slight decline from late spring to the end of the year, a trend not shown by the general construction cost curve. The 20-year trend of both indexes is shown on the opposite page.

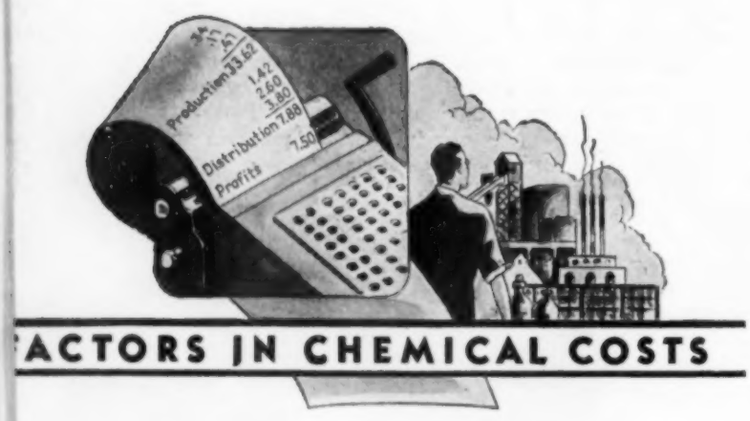
An analysis of the construction cost increase reveals that it comes largely from higher labor rates, though materials prices had some effect. The average hourly rates of skilled construction workers in 20 cities increased from $1.24 in January 1937, to $1.40 at the end of the year. The latter rate is the highest ever reached for the average of 20 cities, though it was closely approached during the pre-depression days. Common construction wage rates have likewise shown a rise during the past year, the average of 20 cities jumping from 60.3 cents in January to 67.8 cents in December, though the rise was hardly perceptible after August. The center chart shows construction wage rate trends compared with those of manufacturing.

Two of the basic construction materials, steel and lumber, increased in price last spring, but cement, the third basic commodity, remained steady in price throughout the year. While mill and wholesale published quotations on steel and lumber held level after June, contractors report a softening of actual purchase prices in these and other building materials along in the fall. The U. S. Bureau of Labor's building materials cost index shows a slight decline for the last half of 1937 after a sharp spring rise, which confirms the contractors' reports.

In analyzing the future trend of construction costs there is every reason to believe the present high level will taper off, though the easing will come largely through materials prices and construction technique rather than from labor cost reductions. Because of the seasonal and intermittent nature of construction employment, labor in this field will always demand, and is for the most part entitled to, higher hourly rates than are paid in other industries. In some places, especially in a few larger cities, the present rates are probably exorbitant, certainly they are far out of line, but in general they are not excessive. Some organized labor leaders now realize that too high wage rates hamper the market for labor in construction and have shown a willingness to rectify unreasonable scales. Even more of them are willing to let present scales stand, thus checking the constant demand for increases, and a few organized labor groups even have passed up increases provided by agreements made some time ago and supposed to have become effective the end of last year.

An ever-present check on rising building materials prices is their highly-competitive nature. When the cost of any one type or kind of material gets out of line there are several substitutes available. The architect and builder now have so many materials from which to choose that a price ceiling is automatically established for all of them.

The competitive situation in materials is simulated to some extent in regards to labor. If, because of the cost of application or fabrication of a building commodity, its use becomes prohibitive, a substitute or alternate material will be found. Then, too, labor-saving devices will be employed if the labor cost on any construction item gets too far out of line.



ACTORS IN CHEMICAL COSTS

Never before has the buyer of buildings had available such a variety of construction materials as exist today, or such an opportunity for building to his exact needs and requirements. No longer does he have to accept standard construction of orthodox design and materials. "Form follows function" is the modern concept of industrial building design and construction. In following that concept lies the greatest opportunity for economy in building.

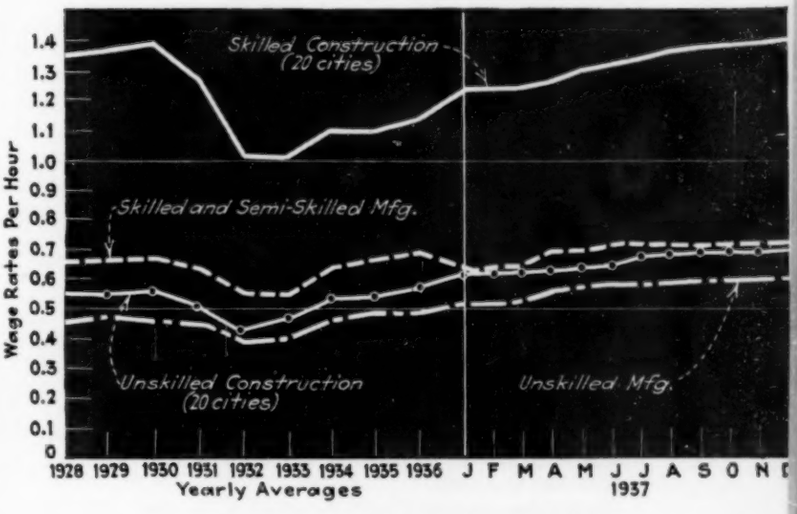
Another point of economy lies in the selection of a competent and experienced contractor. He is equipped with the latest in construction plant and equipment; he is familiar with modern methods and materials; and he attracts the best of skilled labor and building mechanics. He probably will not bid the cheapest, but his bid will be the most economical for the owner in the long run.

Builders for industry are constantly improving their methods and their efficiency of operations. The resulting economies have offset to some extent the increased costs of labor and materials, and social security, unemployment and other taxes; otherwise construction costs today would be much higher.

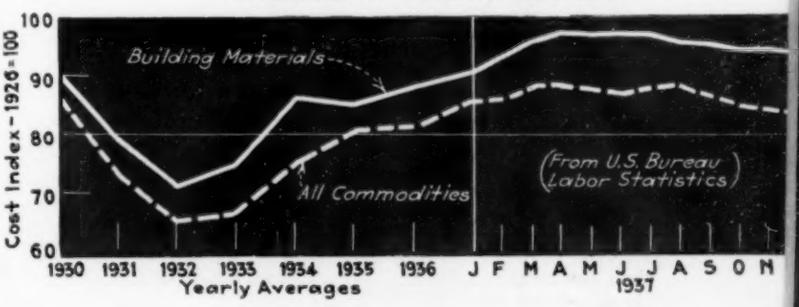
There will be no substantial drop in building costs for some time to come, so industry will gain nothing by waiting for cheaper construction. Today's prices are expected to prevail—with minor fluctuations, of course, for considerable time, though it is impossible to forecast a long-range trend of costs at this time.

Industry is burdened with obsolete, inadequate and unsuited building plant. Replacement of such plant with modern buildings—designed for the exact need and utilizing the new materials of construction, the new structural glass, the new steels and alloys, the new insulations and air-conditioning units, new heating and lighting and countless other new products of all kinds—is just as important as replacement of worn-out old-style machinery. New and improved processes warrant the new and improved building facilities. Industry cannot afford to operate poorly housed.

10-YEAR TREND OF WAGE RATES
CONSTRUCTION AND MANUFACTURING



TREND OF BUILDING MATERIALS COST
COMPARED WITH ALL COMMODITIES



How Budget Research?

By T. W. HOWARD

DEPT. OF MANUFACTURE, U. S. CHAMBER OF COMMERCE
WASHINGTON, D. C.

A NUMBER of large industrial corporations were recently asked by this Department to furnish information on the budgetary and accounting procedures they used for their organized research programs. Industrial research as here used refers to fundamental production research, rather than to the adaptation of an established product to specialized uses or to the requirements of individual customers.

The results of the information contributed by 25 such corporations are summarized and reported in this article. The fields of business and the number of companies contributing information are as follows:

Automobiles	1	Paper Products	2
Chemicals	4	Petroleum Products	1
Electrical Wire and Cable	2	Pharmaceuticals	2
Explosives	1	Plastic Products	1
Food Companies	2	Radio Apparatus	1
Glass	1	Rubber Products	2
Machinery, Electrical	2	Scientific Apparatus	1
Heavy	1	Steel Products	1

All reporting companies effect control of research expenditures either by the establishment of budget allowances to cover a period such as a year or they establish appropriations for specific research projects. Of those that use a periodic budget, 17 establish a budget for each fiscal year, two companies make the budget period six months and one company uses three months. Four companies set up appropriations for individual projects without reference to a fiscal period.

Some companies which set up annual budget allowances tie in also the estimates of the costs of research projects. One company reports as follows:

> An estimate is made of the cost of each project before it is started and it must be approved by the management. Its amount is then deducted from the yearly budget. Any additional amount to complete a project must go through the same procedure.

Some companies, while establishing annual budget allowances, develop a general program for several years in advance. Those companies which use an annual budget for research activities ordinarily establish the allowances at the same time as the budget allowances for the general operation of the company.

One company (electrical manufacturer) uses a dual system of budgets for long range research activities. A budget is set up for a five-year period. This is approximately 15 per cent of the total amount spent for research activities. The remainder, 85 per cent, is budgeted on an annual basis.

One company (paper products), which states that it has no research budget, controls research activities as indicated by the following comment:

> No definite budget is set up for research activities. Agreement is reached between the management and the director of research as to the relative value of current and proposed projects, and the amount of money to be appropriated is subject to modification depending upon fundamental conditions which warrant or limit research activity.

A variety of methods is followed in reaching a determination as to the amount to be expended for research. One company (automobiles) has this to say:

> Research activities, in general, do not produce anything except ideas and therefore, cannot be placed on any sort of production accounting basis, either with respect to budget or cost analysis. As a matter of over-all policy, the cost of operating a research laboratory must be considered for budget purposes and cost analysis from an actuarial standpoint and it cannot always be expressed in dollars and cents. That is to say, many of the benefits of a research organization are so intangible as to be impossible of analysis on a dollar and cents basis. When a specific development is made, the sales value of which can be determined on a dollar and cents basis, we usually find that one good one will pay the cost of operating the laboratories for quite a long time. Anything else, whether tangible or intangible from an accounting standpoint, is return on the investment.
>
> As to the success of research projects, our experience has been that one important development every few years is a good batting average. During the intervening time there are many little things that are accomplished in the way of specific devices and services, the value of which often can never be determined.

Eleven companies state that their budgets are related to the expected value to be obtained from the results accomplished. Three companies relate their budgets for research to the volume of sales. One other company (chemicals) says: "Our research program has not yet reached a point where we can relate the total amount appropriated to results accomplished or to be accomplished. On specific items which have reached a position of stability the budget is directly related to results received or anticipated. Dollar sales are used as a general check against the total research budget, also against the specific budget for a product or group of products, but is usually not the determining factor."

Some companies reach a total of the research budget by a summation of the estimated costs of individual research projects.

No company in the particular group that contributed to this compilation sets aside specific amounts out of profits of preceding years without relation to any other factor. Most of the companies reporting use a combination of methods, only three, as stated above, set their budgets solely on the basis of product sales.

The care with which the research budget of one company (chemicals) is prepared is shown by this statement:

> Budgets are prepared after careful review and discussions of plans with laboratory, sales and executive personnel. A carefully studied list of personnel and salaries of each research group is prepared, provision is made for additions which are decided as necessary within the budget period. No additions are allowed which are not provided for except on approval of a specific proposal stating cost, reasons, etc. Investment in facilities are also budgeted in the same careful manner. Each proposed addition to facilities is presented in full detail showing estimated cost to install, to operate and the results to be accomplished. We find the executive personnel of laboratories are very cooperative and make every effort to live within their budgets.

Most companies that use an annual budget system make provision for its modification during the year covered where such modification is justified. Eighteen companies report this to be their practice. One company (chemicals) reports, for example, that its budget, set up semiannually, is subject to modification as new and worthwhile projects appear. Research budgets, seemingly, are not subject to modification because of fluctuations in business activity. One company (chemicals) says "Modifications in our research budget are made only after careful consideration and for meritorious reasons."

The extent to which a research budget is itemized depends upon the basic methods used in the determination of the gross budget. Six companies make no itemization of the budget. One company carries the details of its budget solely by kinds of expenses such as salaries, fixed charges and supplies. Four companies provide individual amounts for specific research projects, the total of which constitute the gross budget. Nine companies go into complete details with respect to their research budgets, i.e., amounts are given for individual projects and for each project the amounts by the several classes of expense. In general the companies reporting prepare periodic expense and budget comparisons which set forth the actual expenses in considerable detail.

Disposition of Research Costs

Most of the reporting companies charge the costs of the research projects, whether successful or unsuccessful, to the costs of operations for the current period. In some companies the research costs are charged against particular classes of products for which the research work was done. A few companies capitalize the costs of successful projects. One company (paper products) comments as follows:

> In the case of a completed project which yields a tangible beneficial result, the cost of the project is considered as a capitalizable expense and is amortized on the basis of the estimated or definitely established benefit of the result. For example, where a patent has resulted, the cost of the project may be amortized on the basis of the life of the patent; or, in the case of a definite savings accomplished, the cost may be written off at the rate of the savings per year; similarly, where a unit of machinery is the result, the cost may be capitalized as a part of the cost of the machinery and written off as regular depreciation of the equipment.
>
> Where a project is abandoned as valueless, the cost of the project is written off as current research expense.
>
> Where a project is temporarily abandoned due to priority of importance of other projects, the accrued cost is classified as deferred expense and its final disposition determined upon the ultimate result of the completed project.

Another company (electrical wires and cables) charges the research cost of a project which results successfully to product cost over a definite number of parts manufactured, usually not over three years, as development expense. Where the project is abandoned the cost is charged to general development expense which in turn becomes a cost of operation by monthly charges throughout the year.

A third company (electrical machinery) treats the costs of research as follows:

> As regards disposition of costs, three different classes of projects are recognized in our budget as follows:
>
> (a) Projects which, if successful, will directly benefit some specific engineering department or associated company. For such projects an appropriation is requested from the department or company concerned, and, if granted, is included in their engineering budget. The cost of the work is billed monthly. For instance, research on creep of metals at high temperature is billed to the ..... Department.
>
> (b) Projects of a general nature not allocatable to specific apparatus lines, but of interest to all departments. For such projects an appropriation is requested from ..... Department, and the cost, which is billed monthly to that department, is prorated over all designing engineering departments, as part of the company's engineering overhead. Examples, general studies of alloys, etc.
>
> (c) Projects of so fundamental a nature or aiming at the development of so new a device that they are of no immediate interest to any other department. These are carried on laboratory accounts, and appear in no budget other than our own. If successful, and taken over by some other department, they are liquidated, if posible, either by payment of a lump sum or by development credits, handled like royalties paid by that other department and charged to factory cost. In the latter case, payments may continue after full liquidation, so that successful projects may pay in part for unsuccessful ones. Examples of such projects, studies of arcs at high pressure, studies of surface film, development of a new type of insulation, etc.

In connection with a comment on accounting treatment, one company (chemicals) makes the following pertinent observation: "All industrial research projects are successful, i.e., they give useful information but some may not produce a direct assessable profit." The comment of another chemical company is as follows:

> All research expense is written off directly to current operating profit as expenditures are made. Abandonments are used only to remind the sponsors of errors in judgment in the incurring of expenditures that prove valueless.

In some branches of the chemical industry pilot plants are used before production is commenced on a large scale. One company says:

> All research in the laboratory stage is written off currently each month as expense. If a project gets to the pilot plant stage, then such development costs are deferred and absorbed when the project or product gets into production. If it fails after it leaves the laboratory stage it is absorbed in expense as quickly thereafter as consistent. This, of course, must be watched very closely and should not allow an unreasonably high deferred charge to exist. Our experience is that it is generally unwise to defer the writing off of research charges in the early stages of any project for the reason that many times these investigations cover a rather long period and if the venture is not successful you are confronted with a sizable expenditure you must write off and if it is successful, it becomes quite a burden on the new venture.

One company (rubber products) makes the following interesting comment under this heading in explanation of why it is impossible to charge the research costs to the products involved.

> In addition to specific projects, where a definite return is possible, we plan a certain amount of fundamental research to act as a stimulus for the whole department and to attract and hold men of purely scientific bent.

These pertinent comments have been submitted to the participating companies and are presented here in the belief that other industries may benefit from the budgetary philosophy and accounting procedures of these larger industrial corporations.

FACTORS IN CHEMICAL COST

Depreciation Rates for Process Equipment

Editor's Note: Final arbiter on depreciation, at least as far as tax purposes are concerned, is the Bureau of Internal Revenue of the U. S. Treasury Department. Some years ago it issued as a guide to taxpayers a preliminary report on depreciation studies that included in addition to buildings and building equipment, some interesting figures on the probable useful life and depreciation rates of a wide variety of equipment used in the chemical process industries. This report is out of print and no longer available but chemical engineers may find some useful data in the tables that have been reprinted here from this bulletin of the Commissioner of Internal Revenue

A REASONABLE RATE for depreciation is dependent not only on the prospective useful life of the property when acquired, but also on the particular conditions under which the property is used. In other words a company's operating policy and the accounting procedure followed with respect to repairs, maintenance, replacements, charges to capital account and to the depreciation reserve must all be taken into consideration. The use of the rates of depreciation shown in the following table is not prescribed in any particular case and the Bureau of Internal Revenue cautions its employees against applying these rates arbitrarily. They are set forth solely as a guide or starting point from which correct rates may be determined in the light of the experience of the property under consideration and all other pertinent evidence.

The estimates of useful life given are for new equipment only. In applying the depreciation rates shown here, consideration should be given to salvage values, to that portion of the service life already used, and to that portion of the cost or other basis already recovered through prior depreciation or other allowances. Consideration should also be given to any unusual conditions incident to the operation of the equipment.

Probable Useful Life and Depreciation Rates for Chemical Process Equipment

Source: U. S. Bureau of Internal Revenue

	Probable useful life *Years*	Depreciation rate *Per cent*
Acids —		
Acetic —		
Blow cases, cast iron and copper	3	33⅓
Columns, fractionating	8	12½
Condensers —		
Copper	10	10
Duriron	14	7
Lead	6	16⅔
Motors	14	7
Pipes —		
Aluminum	3	33⅓
Glass	5	20
Acid —		
Copper	10	10
Rubber	8	12½
Water	10	10
Pots	17	6
Pumps, vacuum	7	14
Receivers, acid (stoneware)	14	7
Scrubbers (stoneware)	14	7
Receivers, acid, for product (stoneware)	20	5
Stills —		
Cast-iron	12½	8
Refining, copper	14	7
Refining, heating coil	3	33⅓
Tanks, storage —		
Steel	12½	8
Wood	25	4
Muriatic —		
Air lifts (hard rubber)	10	10
Cars, tank	10	10
Coolers	10	10
Elevators, bucket	10	10
Exhausters (rubber lined)	8	12½
Furnaces, Mannheim	8	12½
Flues (earthenware)	10	10
Furnaces, pot and muffle	10	10
Furnaces, retort	8	12½
Grinders and coolers, salt cake	12	8⅓
Motors	14	7
Pipes —		
Acid (hard rubber)	7	14
Chemical ware	2	50
Oil	20	5
Water	4	25
Pots, condensing (earthenware)	7	14
Acids—Continued		
Pumps and blowcases —		
Chemical ware lined	3	33⅓
Rubber-lined blowcase	5	20
Storage tanks (wooden, rubber lined)	14	7
Tanks, sulphuric-acid storage (steel)	20	5
Tourills (silica)	10	10
Towers, absorbing	10	10
Nitric —		
Blowers (stoneware)	5	20
Blow cases (earthenware)	2	50
Condensers (duriron)	12	8⅓
Condensers, S bend (stoneware)	2½	40
Elevators and conveyors (screw)	10	10
Flues, gas (duriron)	8	12½
Pans, niter cake (steel)	14	7
Pipes and fittings (earthenware duriron, lead)	2	50
Pumps, sulphuric (iron), centrifugal	5	20
Receivers (stoneware)	5	20
Retorts, 24-hour service	2½	40
Tanks (steel)	10	10
Towers, condensing	9	11
Sulphuric (chamber) —		
Air lifts, acid	10	10
Blowers, gas (lead)	17	6
Blowcases	10	10
Chambers	17	6
Coolers, acid (lead coil), for salt water	10	10
Fans (cast iron)	10	10
Pipes (lead)	10	10
Pots, niter	20	5
Pumps, acid	5	20
Tanks (steel), acid storage, average weak and strong acid	20	5
Tanks, tower, acid distributing	8	12½
Towers, Gay Lussac	20	5
Towers, Glover	20	5
Sulphuric (contact) —		
Air lifts	14	7
Blowcases (cast-iron and steel)	5	20
Acids — Continued		
Blowers —		
Connersville	7	14
Sturtevant	17	6
Burners —		
Brimstone	10	10
Glens Falls	10	10
Herreshoff	15	6⅔
Wedge, salt-water cooled	15	6⅔
Wylde	14	7
Coke boxes	17	6
Combustion chambers, brimstone	10	10
Compressors, air	15	6⅔
Contact mass, including plates and supports	17	6
Converters	14	7
Conveyors and elevators	10	10
Coolers —		
Drying acid	10	10
Gas	14	7
Gas, tower	10	10
Product	6	16⅔
Dust chambers (brick)	14	7
Filters, preliminary	11	9
Flues (iron)	13	7½
Gages, meters, pyrometers	14	7
Heaters, preliminary	14	7
Melters, brimstone	10	10
Motors	17	6
Pipes, acid	10	10
Platinum, in catalyst	50	2
Pumps, acid (iron)	7	14
Pumps, acid (lead)	8	12½
Separators	14	7
Sublimers, brimstone	10	10
Tanks —		
Roasted ore storage (steel)	20	5
Storage (lead)	20	5
Storage (steel)	17	6
Tank cars (steel)	12½	8
Towers —		
Absorbing	9	11
Cooler, cold scrub	12	8⅓
Dry	10	10
Oleum	10	10
Scrub	10	10
Transferrers	9	11

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Alkalis Scale New Production and Sales Peaks in 1937

EDITORIAL STAFF

LEAVING 1929 far behind, the year just past saw the alkali industry establish new records which have finally and completely dispelled any fear that may have been felt for the wisdom of the extensive plant expansions of 1934 and 1935. Subject to later revision when the 1937 Census figures become available, it is now estimated that soda ash was produced to the extent of 3,051,000 tons, compared with our estimate of 2,778,000 tons in 1936 and the production of 2,508,559 tons reported by the Census for 1935. Thus the 1929 record of 2,682,216 tons has twice been exceeded: by nearly 3 per cent in 1936; and by more than 12 per cent in 1937. The total for 1937 included an estimated 110,000 tons produced at natural soda plants, an increase of 10 per cent over the natural production of 1936.

Considerable soda ash capacity was added to ammonia soda plants during the year, perhaps 150,000 annual tons, bringing the total capacity to about 3,500,000 tons per year. Capacity at natural soda ash plants is about 140,000 tons annually. Thus the ammonia soda industry operated at an average of 83 per cent of capacity, as in 1936, while natural soda production averaged 78 per cent. Had it not been for the marked fourth quarter decline, there is no telling where ash production might have gone. For example, in May the production rate is believed to have been at nearly 95 per cent of capacity —an all-time record for the industry—while by December it had dropped to approximately 70 per cent.

Soda Sales Trend

Sales of soda ash increased in about the same ratio as production, namely 8.4 per cent, from the 2,082,000 tons which we estimated for 1936, to the record of 2,258,000 tons estimated for 1937. Soda ash sales have consistently held above the general level of business in recent years. Taking an average of *Business Week's* weekly indices of business activity for each of the several years, and considering 1929 as 100, general business stood at 69 in 1931; 55 in 1933; 60 in 1935; 66 in 1936; and 69 in 1937. For comparison, with 1929 again as 100, soda ash sales stood at 83 in 1931; 91 in 1933; 103 in 1935; 115 in 1936; and 124 in 1937. Once again the rapidly increasing importance of the chemical industry has been convincingly demonstrated.

Increased use of soda ash was shown in nearly every consuming industry, as indicated in the accompanying tabulation of *Chem. & Met.'s* annual estimates. Percentagewise, the largest increase was in exports which showed a rise of nearly 23 per cent. Much more important on a tonnage basis, however, was the increased use in the largest of the consuming industries, glass, where a rise in excess of 10 per cent was indicated. Glass had a good year in all departments, with particular activity in containers, flat and plate glass. Strikes early in the year, with a slackening in automobile glass toward the close, did not prevent a record consumption of ash in this field.

The second largest group of soda ash uses, that is, the manufacture of chemicals, likewise saw a considerable increase. The 9.4 per cent rise indicated in this classification was not dependent on increased conversion of soda ash to nitrate, for this process has been held at a substantially constant output for several years. Nor did it include ash going to bicarbonate or caustic soda, since those are not factors in our estimates of soda ash sales. Rather it arose from a substantially expanded production of nearly every other chemical in the making of which soda ash is used.

Among other large uses a mixed trend was evident. Soap production increased only slightly over 1 per cent, a situation which was caused chiefly by the imposition of excise taxes on imported oils, resulting, it is claimed, in a shift of part of the United States production to Canadian plants. A mod-

Estimated Distribution of Soda Ash Sales in the United States

Consuming Industries	1935 Short Tons (Revised)	1936 Short Tons (Revised)	1937 Short Tons
Glass	662,000	780,000	860,000
Soap	170,000	184,000	186,000
Chemicals	590,000	640,000	700,000
Cleansers and modified sodas	120,000	130,000	140,000
Pulp and paper	80,000	90,000	100,000
Water softeners	35,000	38,000	38,000
Petroleum refining	11,000	11,500	12,000
Textiles	48,000	44,000	38,000
Exports	43,500	44,000	54,000
Miscellaneous	111,500	120,500	130,000
Totals	1,871,000	2,082,000	2,258,000

Estimated Distribution of Caustic Soda Sales in the United States

Consuming Industries	1935 Short Tons (Revised)	1936 Short Tons (Revised)	1937 Short Tons
Soap	96,000	104,000	106,000
Chemicals	118,000	130,000	144,000
Petroleum refining	81,000	88,000	97,000
Rayon and cellulose film	163,000	170,000	186,000
Lye	38,000	46,000	48,000
Textiles	34,000	43,000	45,000
Rubber reclaiming	11,000	14,000	16,000
Vegetable oils	14,000	14,500	15,500
Pulp and paper	38,000	43,000	48,000
Exports	69,500	77,000	100,000
Miscellaneous	56,500	63,500	67,500
Totals	719,000	793,000	873,000

erate increase of about 8 per cent is estimated for cleansers and modified sodas while in pulp and paper, an 11 per cent rise is indicated. Nearly 8 per cent more ash went into miscellaneous uses and perhaps 4 per cent more to petroleum refining. There appears to have been little if any change in water softeners while the use of ash in wool scouring decreased by about 14 per cent, according to current indications. Wool's excellent year in 1935 has not been repeated. Both 1936 and 1937 have exhibited declines from the preceding year.

Caustic Soda Situation

Chlorine demand in excess of the requirements for the equivalent caustic soda continued during 1937 so that there is still a discrepancy as previously noted, and still a certain relatively small proportion of caustic which cannot readily be absorbed by domestic markets. By 1935 this situation had grown sufficiently acute to force an investigation of processes for producing chlorine without caustic. One of these processes, a modern version of an old process of reacting common salt and nitric acid to produce chlorine and sodium nitrate, was tried experimentally in 1935, but sent back to the laboratory in 1936. During the year just passed the process was reported to have been worked on a semi-commercial scale, although its production of chlorine is believed to have been too small to have affected the chlorine-caustic situation materially.

According to estimates, the total production of caustic soda in 1937 stood at 931,000 tons, compared with our revised estimate of 850,000 tons in 1936 and the Census figure of 758,543 tons in 1935. Customarily about 5 per cent of the caustic production reported by the Census is consumed where made, so that it appears that with distribution at the estimated rate of 793,000 tons in 1936 and 873,000 tons in 1937, a near balance was achieved with the 95 per cent of production that is available for sale. Possibly 13,000 tons was added to stocks in 1936 and 11,000 tons in 1937. It appears that the lack of balance is no longer one to cause the industry much worry.

During 1937 caustic soda production is believed to have been split between 485,000 tons made by the lime-soda process and 446,000 tons produced electrolytically. For comparison, our estimates for 1936 include 456,000 tons of lime-soda and 394,000 tons of electrolytic caustic, while the Census for 1935 showed 436,980 tons and 321,563 tons respectively.

Production of Caustic Soda in the United States

(Short Tons)

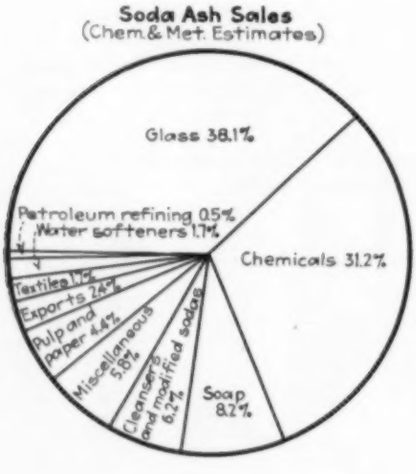
Year*	Lime-Soda	Electrolytic	Total
1921	163,044	75,547	238,591
1923	314,195	122,424	436,619
1925	355,783	141,478	497,261
1927	387,235	186,182	573,417
1929	524,985	236,807	761,792
1931	455,832	203,057	658,887
1933	439,363	247,620	686,983
1935	436,980	321,563	758,543
1936 (revised)	456,000	394,000	850,000
1937 (estimated)	485,000	446,000	931,000

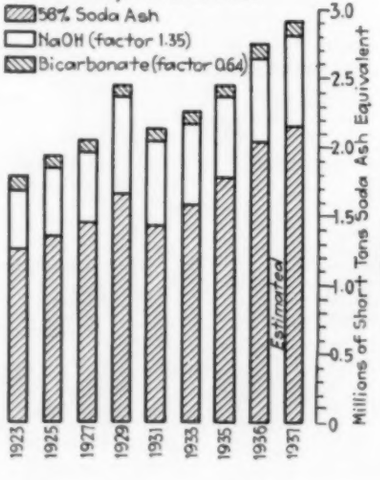
* Figures for 1921–1935 are from the U. S. Bureau of the Census. Electrolytic caustic soda figures do not include that made and consumed at wood-pulp mills, estimated at about 30,000 tons in 1927 and 1929, at about 24,000 tons in 1931, 21,000 tons in 1933, 20,000 tons in 1934, 17,000 tons in 1935, 19,000 tons in 1936 and 20,000 tons in 1937.

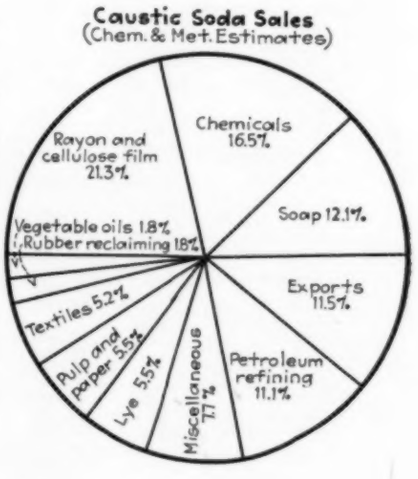
Caustic Sales Increase

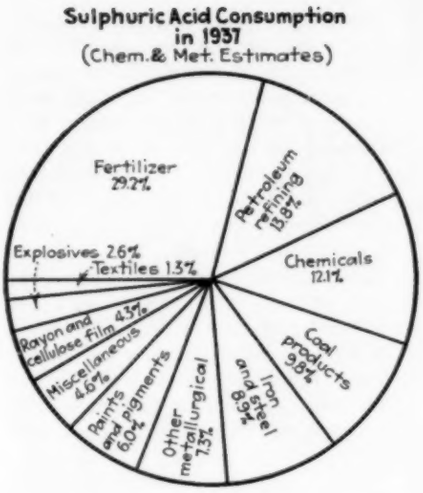
With an indicated increase in caustic production of some 9.5 per cent from 1936 to 1937, the increase in sales was of the order of 10 per cent. A greater or lesser advance was shown in every consuming field. The largest percentage increase occurred in caustic exports, which rose an even 30 per cent. A small use—rubber reclaiming—came next with an advance of over 14 per cent. The pulp and paper industry required nearly 12 per cent more than in 1936, while a considerable increase of 10.8 per cent occurred in the uses for chemical manufacture. Petroleum refining took some 10 per cent more caustic than in the preceding year and rayon and cellulose film, experiencing another record year, over 9 per cent more. The trend toward recovery of caustic from the steeping presses in viscose manufacture, which for several years has been reducing the industry's unit caustic requirements, is now believed to have become substantially complete. Were it not for the use of dialysis in this operation the rayon and cellulose film industry would have required approximately 70,000 tons more caustic during 1937 than was actually used.

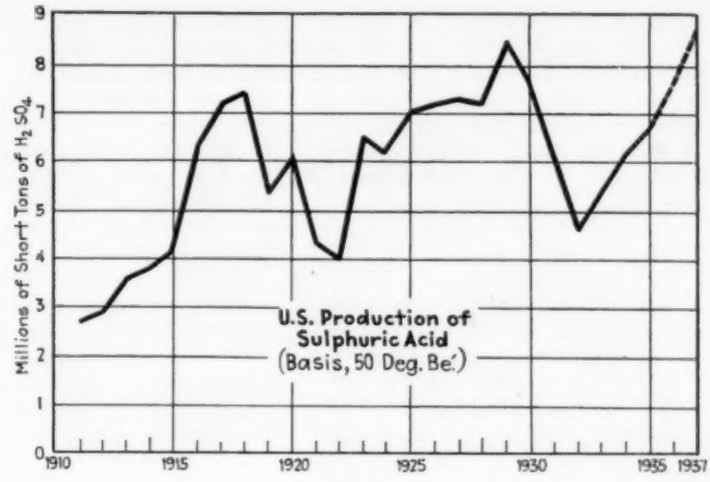
A small tonnage increase, amounting to 6.9 per cent, was the contribution of vegetable oils to the general improvement in caustic consumption, while miscellaneous uses rose by 6.3 per cent and requirements in cotton textiles, by 4.6 per cent. The increase in packaging of caustic soda for sale as lye is indicated as about 4.4 per cent, while another small increase,











slightly under 2 per cent is estimated for the soap industry.

The year appears to have been without important technical developments on the part of the soda ash industry. There has been some investigation in Russia, Germany and Japan of a modification of the Solvay process employing liquid ammonia, but the process is of no immediate interest in the United States. Among certain of the electrolytic caustic producers there has been a revival of interest in the mercury cell, which, despite its large investment cost, offers attractive advantages in producing a strong cell liquor requiring no purification which can be shipped as liquid caustic without the need for concentration.

1937 New Reference Standard for Sulphuric Acid Industry

EDITORIAL STAFF

LIKE THE REPORTS of Mark Twain's death, rumors predicting an early demise for sulphuric acid have been greatly exaggerated. And since in recent years commentators have fallen into the habit of taking pot shots at this progenitor of business indicators, the acid interests may be forgiven a few quiet chuckles in the light of 1937 statistics. That ace of boom years, 1929, is no longer a mark at which to shoot. Few would have predicted that year would be passed at any time in the near future, but passed it was, by more than 5 per cent in acid consumption and perhaps by 7 per cent in production.

Our estimates, of course, must be subject to later revision when the 1937 Census figures have been compiled. But pending their issuance we submit that a total in the neighborhood of 8,763,000 short tons of sulphuric acid (on a 50 deg. Bé. basis) was consumed. This is more than 30 per cent in excess of the 6,725,000 tons of 1935, and 14.8 per cent ahead of the 7,639,000 tons in the excellent year, 1936. Since stocks of sulphuric acid are seldom large and are relatively unchangeable, it is ordinarily reasonable to consider consumption and production as substantially equal. In 1937, a new factor entered the picture. So rapid was the business decline of the last three months of the year that the previous high rate of acid production could not be maintained. Sulphur and pyrites shipments to the plants were largely continued as before, but it is known that stock piles in the hands of consumers began to increase in the latter part of the year. Just how much of this raw material went unused cannot be known, but a sampling of a part of the using industry indicates that whereas some 9,500,000 tons of acid (50 deg. basis) might have been produced from all the available materials, this

Estimated Distribution of Sulphuric Acid Consumed in the United States

(Basis, 50 deg. Bé.)

Consuming Industries	1935 Short Tons (Revised)	1936 Short Tons (Revised)	1937 Short Tons
Fertilizer	1,720,000	1,987,000	2,560,000
Petroleum refining	980,000	1,100,000	1,210,000
Chemicals	940,000	985,000	1,060,000
Coal products	625,000	770,000	860,000
Iron and steel	630,000	700,000	780,000
Other metallurgical	520,000	600,000	640,000
Paints and pigments	400,000	450,000	525,000
Explosives	175,000	222,000	230,000
Rayon and cellulose film	303,000	330,000	380,000
Textiles	90,000	108,000	112,000
Miscellaneous	342,000	380,000	406,000
Totals	6,725,000	7,632,000	8,763,000

total was probably closer to 8,900,000 tons. It is evident that the stocks of finished acid at acid plants and in the hands of their customers were considerably larger at the turn of the year than is usual in an industry with so difficultly storable a product.

Sulphur Sources

Sulphur production at the mines, total shipments and shipments to domestic consumers were higher in 1937 than ever before. Early estimates for production of 2,670,000 long tons, coupled with shipments in the neighborhood of 2,444,000 tons, indicate an increase of stocks at the mines of about 226,000 tons. By way of comparison, 1936 sulphur production was reported by the U. S. Bureau of Mines to have been 2,016,338 long tons, with shipments of 1,968,820 tons. Since the stocks at the mines amounted to 3,100,000 tons at the end of 1936, they were probably about 3,326,000 tons at the close of 1937. Where sulphur exports ran to 547,199 tons in 1936, they were estimated at 690,000 tons in 1937. An estimated usage of sulphur for non-acid purposes of some 564,000 tons reduces the sulphur available for acid in 1937 to about 1,190,000 tons. Assuming that a total of 90,000 tons shipped to domestic users was unused during the year, it appears that some 5,730,000 short tons of 50 deg. Bé. acid was produced from the sulphur burned.

As usual, of course, there was a substantial production of acid from sources other than brimstone. Had the 590,000 long tons of domestic pyrites which we believe was delivered to acid plants all been employed, 1,197,000 short tons of acid would have been produced, while the indicated deliveries of 510,000 long tons of imported pyrites would have produced 1,115,000 short tons of acid. Owing to the stock pile situation noted above, however, our production estimates have been decreased to 1,110,000 tons of acid from domestic and 1,060,000 tons from imported pyrites. A high degree of metallurgical activity may well have yielded even more than the 1,000,000 tons of byproduct acid which we estimate for the year, but this figure, at least tentatively, is chosen in arriving at our total production estimate of 8,900,000 short tons of acid produced.

In comparison with 1937 figures, in 1936 acid production required 542,976 long tons of domestic and 429,313 long tons of imported pyrites, while byproduct production included 283,422 short tons of acid (50 deg. basis) at copper and 632,352 tons at zinc smelters, or a total of 915,774 tons, according to the Bureau of Mines.

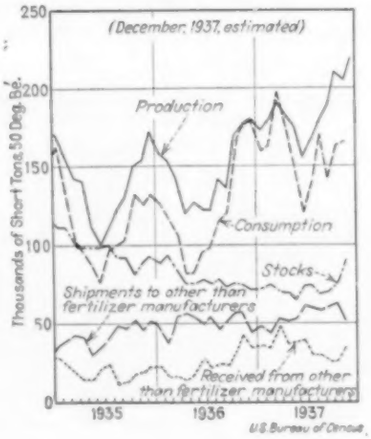
Although some of the industries using sulphuric acid fell off considerably during the late months of 1937, every one of them contributed substantially to the increase in acid consumption for the year, as indicated in the accompanying tabulation of *Chem. & Met.'s* annual estimates.

Most notable was the tremendous increase in acid used for superphosphate manufacture. Through A.A.A. assistance to farmers and for other reasons the fertilizer industry turned out more plant food than ever before. About 30 per cent was the estimated increase in superphosphate manufacture, which took by far the largest acid tonnage of any of the using groups, and considerably more than was required for this purpose in 1929, according to preliminary estimates.

Other Record Uses

A year in which both lithopone and titanium pigments boomed brought an indicated 16.7 per cent increase to the paint and pigment field. Rayon and cellulose film, although only moderately large consumers of acid, required about 15 per cent more than in 1936. Metallurgical requirements for coke pushed the acid consumption at coke ovens up an estimated 11.7 per cent, while the use of acid in pickling iron and steel increased by nearly the same percentage. Although steel passed through a period where production fell from 92 to 19 per cent of capacity in 1937, its average was high, particularly in strip and tin plate production, the large consumers of pickling acid. Other metallurgical pickling operations were not at such a high level but still required an estimated increase of 6.7 per cent of acid, while petroleum refining, the second largest acid user, consumed in the neighborhood of 10 per cent more acid than in 1936. Other estimated increases ranged from 7.6 per cent for chemicals, through 6.8 per cent for miscellaneous uses, to slightly over 3.5 per cent each for textiles and explosives.

Sulphuric acid in fertilizer plants, 1935–37



New Construction

Considerable sulphuric plant construction was undertaken, contracted for, or completed during 1937. Four contracts were signed for the construction of vanadium contact plants totalling 300 tons per day capacity on a 100 per cent basis. Chemico sludge conversion units totalling 150 tons per day capacity went into operation within the United States, together with an additional plant of this type outside the United States. New vanadium contact plants and additions to existing plants totalling over 400 tons per day capacity were put into production during the year, together with the box chamber plant mentioned in our February, 1937, review.

During 1936 and 1937 three plants employing the Koppers sodium phenolate process to remove hydrogen sulphide from refinery gases were completed and ready for operation. Two of these plants are reported to be producing sulphuric acid from this material at present, while the third is believed still to be operating exclusively on sulphur. No other threat to the supremacy of sulphur and pyrites was evident during the year. Interest in the production of elemental sulphur from pyrites and other sulphur bearing ores continues outside the United States, but the economics of such processes appears as yet to offer no attraction in this country, owing to the low cost and extensive character of available sulphur and pyrites supplies.

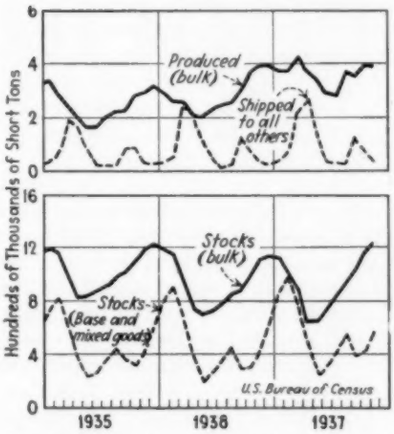
Government Aid to Farmers Produced All Time Fertilizer Record

By R. S. McBRIDE
EDITORIAL REPRESENTATIVE, CHEM. & MET.
WASHINGTON, D. C.

ALL-TIME records were established in 1937 for the quantity of plant foods marketed by the fertilizer industry and by the materials industries which serve it with potash, phosphate, and nitrogen chemicals. Sales of fertilizer were approximately 8 million tons, equal to the output of the largest previous year on record in mere weight or bulk. But the plant food content of this tonnage far exceeded any previous record, as the concentration of the three major constituents was higher than in any recent year, and outstandingly higher than in the previous years of high tonnage, 1928 to 1930 inclusive.

Sales during 1938 are not expected to equal last year's record; but the more pessimistic forecasts of 15 to 20 per cent declines are not anticipated by the more careful analysts who have studied the situation. A decline of 5 to 10 per cent both in total tonnage and in plant food sales seems more nearly to correspond with the coming season's probable activity.

Last year's achievement in successfully marketing fertilizer was made possible in substantial measure by Government aid under the soil conservation program of A.A.A. Farmers naturally could not resist having a large part of their fertilizer bill paid by Uncle Sam, and great tonnages were sold with this Government aid. An important consequence of this was the record-making yield of certain crops. For example, never before was last year's production in pounds of lint cotton per acre even approached. This high yield, made possible by intensive fertilizer use during an otherwise favorable season, accounts for the record total crop which is now embarrassing the whole agricultural program.



Production, shipments and stocks of superphosphate in the United States

It is not to be expected that either farmers or the Department of Agriculture will continue such extensive support for fertilizer use in cotton growing. Forecasts of shrinking fertilizer markets have been based largely on this fact. But close analysts of the fertilizer market discover that cotton now takes only about 21 per cent of all fertilizer, not the 50 or 60 per cent which was once used on that crop. Consequently even a 20 per cent cut in fertilizer use on cotton (and not more than that is expected) would mean only a 4 per cent curtailment in fertilizer usage from this cause.

Price Policies

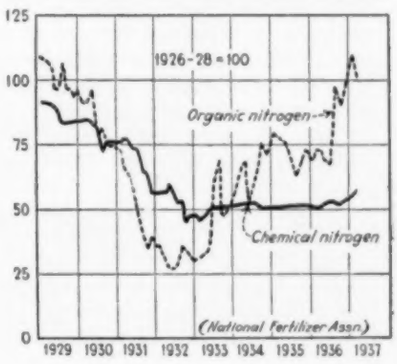
Some enthusiastic controversy is going on within the fertilizer and affiliated industries as to proper pricing policies for 1938. An understanding of this controversy is necessary to anyone who wishes to appraise either technical or market trends. The lines of battle are approximately these:

Farm purchase of fertilizer in any season is roughly proportional to the cash farm income of the *preceding* year. Farm income in 1937 was high. Sales of fertilizer in 1938 should, therefore, be greater than during any recent year. But the factors discussed above may outweigh the mere cash and credit situation. Farmers know that their income is likely to shrink, which makes them conservative spenders. They know that they will meet serious difficulties if they plant crops to augment surpluses, as of cotton. Hence, they will probably buy less fertilizer.

All agree, so far; but—the fertilizer man of one school then concludes that "we must therefore raise the price of fertilizer so that our gross income as fertilizer makers will not be cut as the tonnage sold declines." This philosophy is defended on the theory that the fertilizer man is "entitled" to this section of the farmer's available cash, and that the way to get it is to raise prices.

Those with the longer range view argue quite differently. They recognize that raising prices at this particular time would be most unfortunate. They even fear that Government competition (like T.V.A.) and

Fluctuation of prices of nitrogenous fertilizer materials in the United States.



farmer criticism would be cultivated. They believe that in the long run the profits of the industry will be greater if conservative pricing prevails in 1938.

Neither school of thought will prevail generally. A few price rises have already been suggested or arranged. More are expected. But no epidemic throughout the fertilizer using states is likely.

Potash Records

Shipment of potash for agricultural use in 1937 for the first time in history closely approached 500,000 tons of K_2O. This apparent consumption exceeded the previous (record) year by 15 per cent or more. (Exact ratios cannot be given, as no complete figures for the year are available at the time of writing.) Certainly next year is not likely to exceed last year's record, but intensive sales effort may hold it close to record levels. Merchandising effort to this end is being made in districts and on many of the crops that until lately have not been considered to be big potash users.

Fundamental research is being done on the need for and effect of potash; and important conclusions have been developed recently. For example, it has been shown that to some extent sodium can increase potash response. Observed effects from 4 per cent K_2O in the presence of abundant sodium may appear, under test conditions, almost as favorable as 5 or 6 per cent K_2O would give in the absence of sodium. In other cases the deficiency of very minor soil constituents has been found to modify potash effects markedly.

Phosphorus and Its Compounds

Three large electric furnace plants will process phosphate rock to make phosphorus or its chemicals during 1938.* Several smaller units are also operating, at least one of them on a commercial scale. Thus phosphorus has become suddenly an industrial chemical of great importance.

Chem. & Met. has already described extensively the Monsanto Chemical Co.'s phosphorus equipment and plans. Less completely it has described the furnace projects of the Victor Chemical Works which is continuing operation of its blast furnace unit near Nashville, and has started its electric furnace plant near Mt. Pleasant, Tenn. Another phosphorus products plant was announced at the year end by The Phosphate Mining Co., which is just now beginning operation of a large electrothermal unit for the manufacture of elemental phosphorus at Nichols, Fla. The company will use its own surplus power, process its own phosphate rock, and manufacture a variety of industrial chemicals, as well as fertilizer phosphate products. The major item of the latter group will be a 50 per cent superphosphate to be marketed under the trade name of "Electrophos".

During the past year strenuous official effort was made to see if it might not be possible to process Western phosphate at some of the Government power projects in the Inter-Mountain country. As previously indicated in the pages of *Chem. & Met.* that development appears to require subsidy in order to succeed. At present Anaconda production seems more than enough to fill the readily accessible markets of that territory. And the output from Trail continues to serve West Coast markets, and provide substantially for export.

At South Amboy, N. J., American Agricultural Chemical Co. continues its industrial chemical work in the field of electric furnace phosphate products. Several other smaller or experimental units have been reported by other concerns, and commercial development is frequently rumored. But official announcement does not yet indicate that any of the rest of the furnace processes has achieved full commercial stature. Whether they do so soon will probably depend more than anything else on the relative cost as compared with phosphate products made by acid processes.

Comparative Economics

Critical analysis of various conditions has led disinterested but competent onlookers to conclude that in general acid phosphate remains cheaper than furnace products of like grade. One close student of this situation states that even a brand-new acid and superphosphate plant appears still to have an advantage in lower cost per ton of P_2O_5 made. For an electric furnace

Chile Nitrate Production and Sales, 1932-1937

(From Office of American Commercial Attache, Santiago)

Fiscal Year	Production, Metric Tons	Exports, Metric Tons	Sales, Metric Tons	Profits of Sales Organizations,[3] Pounds Sterling
1932/33[1]	450,391	269,841	819,450	No figure
1933/34[2]	536,608	1,172,017	1,021,271	1,286,000
1934/35[2]	1,133,444	1,260,897	1,274,438	2,153,000
1935/36[2]	1,218,977	1,358,552	1,346,000	2,123,000
1936/37[2]	1,305,220	1,495,966	1,533,767	2,415,042

[1] The Compania de Salitre de Chile, in liquidation.
[2] The Corporacion de Ventas de Salitre y Yodo de Chile
[3] Chilean Law No. 5350.

World Production and Consumption of Nitrogen

British Sulphate of Ammonia Federation estimates for the indicated fertiliser years, all expressed in thousands of metric tons of contained nitrogen.

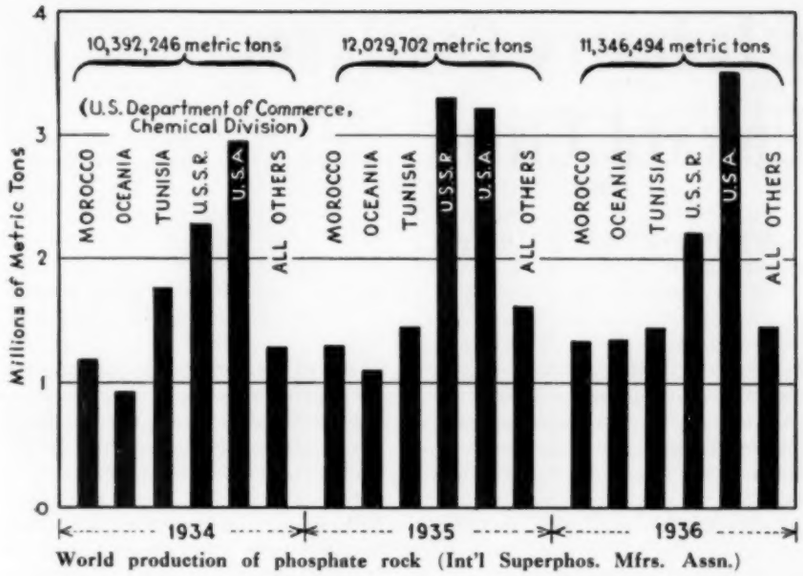
Production:—	1927/28	1928/29	1929/30	1930/31	1931/32	1932/33	1933/34	1934/35	1935/36	1936/37
Sulphate of Ammonia:										
Byproduct	368	376	425*	360	302	258	307	321	365	407
Synthetic	367	485	442	349	522	560	535	533	630*	654*
	735	861	867	709	824	818	842	854	995*	1,061*
Cyanamide	198	192	264	201	134	168	195	232	270*	285*
Nitrate of lime	105	136	131	110	79	118	107	153	156*	159*
Other forms of Nitrogen**:										
Synthetic	242	383	427	393	348	462	516	607	720*	843*
Byproduct	54*	51	51	31	30	40	48	45	45	40
Chile nitrate	390	490*	464	250	170	71	84	179	192	206
Total production	1,724	2,113	2,204	1,694	1,585	1,677	1,792	2,070	2,378*	2,594*
Percentage increase or decrease	*+30.4%*	*+22.6%*	*+4.3%*	*−23.1%*	*−6.4%*	*+5.8%*	*+6.9%*	*+15.5%*	*+14.9%*	*+8.4%*
Consumption:—										
Manufactured Nitrogen	1,249	1,453	1,587	1,377	1,417	1,620	1,714	1,876	2,182*	2,433*
Chile nitrate	393	419*	364	244	138	127	164	195	218	242
Total consumption	1,642	1,872	1,951	1,621	1,555	1,747	1,878	2,071	2,400*	2,675*
Percentage increase or decrease	*+20.8%*	*+14.0%*	*+4.3%*	*−16.9%*	*−4.1%*	*+12.3%*	*+7.5%*	*+10.3%*	*+15.9%*	*+10.7%*
Agricultural consumption about	1,460	1,670	1,750	1,455	1,412	1,586	1,673	1,812	2,068*	2,344*
Percentage increase or decrease	*+22.7%*	*+14.4%*	*+4.8%*	*−16.9%*	*−3.0%*	*+12.3%*	*+5.5%*	*+8.3%*	*+14.1%*	*+13.5%*

* Record.

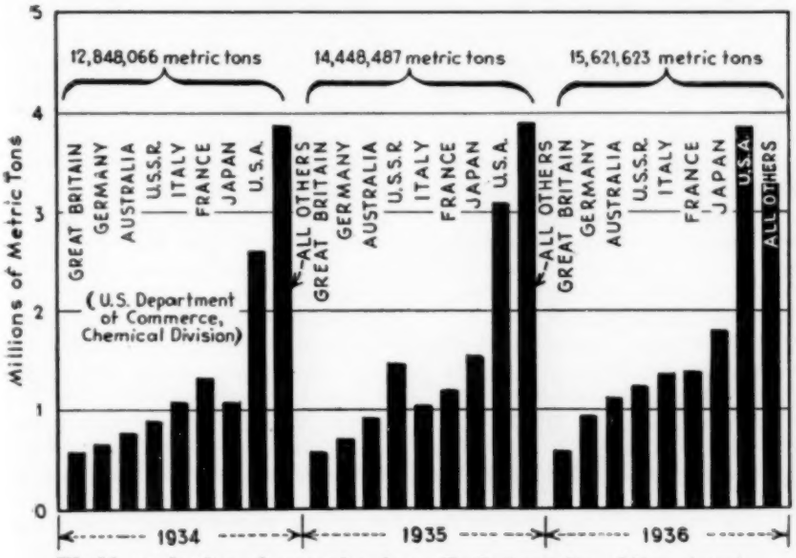
** Including nitrogen products used for industrial purposes (except Chile nitrate) and ammonia in mixed fertilizers.

Note.— Fertilizers are included in these tables under the final form as sold, so that, for example, cyanamide if converted into sulphate of ammonia is included under synthetic sulphate of ammonia, or, if into ammophos, is included under other synthetic nitrogen.

*Editor's Note: The number and rating of electric furnaces for phosphoric acid production already developed to the point of factory operation is believed to be about as follows: Monsanto, three furnaces rated at 12,000 kw. each; T.V.A., two furnaces rated at 6,000 kw.; Victor, one furnace rated at 8,000 kw.; Phosphate Mining, one furnace rated at 4,000 kw.; and American Agricultural Chemical, one furnace rated at 3,750 kw.



World production of phosphate rock (Int'l Superphos. Mfrs. Assn.)



World production of superphosphate (Int'l Superphos. Mfrs. Assn.)

unit one would need about $2,000,000 in capital, and should have power at 2 to 2¼ mills per kilowatt-hour in order to meet the present acid processes on an equal cost footing. This comparison apparently is about equally true whether one is to calculate the costs on 18 to 20 per cent superphosphate, or on the basis of triple-super of 45 to 50 per cent concentration. The more concentrated product costs more per unit of plant food at the point of production, but may be cheaper at the point of use if long freight hauls are involved.

Even with the large increases in consumption of fertilizer chemicals last year there was almost negligible use of furnace phosphates by agriculture, except the products of T.V.A. Large tonnages from the Valley were distributed for experimental, demonstration, and soil improvement projects. For the first time since T.V.A. was established some of its output was sold. These sales were, however, made only to A.A.A. for use under the soil improvement laws. To a limited extent this reimbursement of T.V.A. by its Government contemporary did deprive commercial fertilizer makers of some of the sales that they otherwise might have made. But the total was not great, and no substantial controversy resulted.

During last year T.V.A. announced (in the pages of *Chem. & Met.*) its successful production of metaphosphates. Extensive field tests of these new products are continuing; and it is hoped that the soil benefits will be in proportion to the high concentration, well over 60 per cent of available P_2O_5.

Perhaps outstanding among the new industrial phosphorus chemicals was the large increase in the application of sodium hexametaphosphate, as a boiler compound and for other similar large scale purposes. This and numerous other growing demands for phosphorus chemicals are a great encouragement to the new enterprises making these products. But, as one interested onlooker remarked, there is grave danger that the industry will be greatly overdeveloped, even if only a small percentage of the rumored new plants should materialize. In view of the cost comparisons between furnace and acid methods of production it is not expected that there will be any stampede into this area of business activity during 1938.

International Trade

Exports of fertilizers and fertilizer chemicals from the United States last year were a little less in all classes than during 1936. In each commodity group the figures for 1937 were very close to those for 1935.

Imports of fertilizer chemicals were, as would be expected, much higher than in the preceding several years. The increase in domestic use of fertilizer drew heavily on imported goods of all classes, only ammonium sulphate of all imported goods being supplied in lower tonnage than in the preceding year. This decline in the imports of sulphate was, of course, the result of a large increase in domestic production as a natural consequence of active metallurgical business of the United States.

It is notable in the import tables that 124,000 tons of phosphate materials was brought in during the first 11 months, which is more than three times the imports of the corresponding period two years ago, and two and one-half times those of the preceding year. It is interesting to note that these phosphate imports just about equal the exports of superphosphate and other phosphate material, except raw rock. In the case of potash chemicals, the imports were substantially larger than during preceding years. Domestic production increased also, but not as much as imports.

Plastics Industry Continues Upward Climb

EDITORIAL STAFF

THE PAST YEAR witnessed a continuation of the expansion of the plastics industry. However, the volume of business fell off during the last few months of the year. Fortunately, the break in the demand for the many products has had practically no affect on prices. Among the most interesting features of the period was the threat of the vinyl resins to the safety glass market for cellulose acetate. Renewed activity in poly styrene resins, the marketing of plastic wood and the increased consumption of resins for the treatment of textile fabrics were other important developments that attracted attention.

Cellulose Plastics

The three cellulose plastics, ethyl cellulose, nitrocellulose and cellulose acetate, all continue to make progress. According to the Department of Commerce, cellulose acetate in the form of sheets, rods and tubes amounted to 13,359,962 lb. in 1937 as contrasted with 13,265,544 lb. in the year before. Average price for solid color molding powder is 55c. per lb. Price of transparent material is $1.46 per lb., an increase of about 10 per cent. The principal use for the sheet material is in the manufacture of safety glass. During the last year 80 to 85 per cent of all safety glass contained this plastic. While it is expected that the new polyvinyl acetate resin will compete with acetate for the market during the current and in future years, the acetate should retain some of the market in view of the continued lowering in costs arising in part from a non-solvent process for making thin sheet material.

The acetate molding composition continued its climb, with Tennessee, Eastman, Celluloid Corp., and du Pont all showing substantial increases in production. It is estimated that the 1937 volume produced was at least 33⅓ per cent greater than the previous year. The injection molding process now accounts for over 80 per cent of the consumption of this material. Several new varieties of machine with increased capacity became available. Machines are rapidly being developed that will be capable of producing larger articles. These machines will further increase the field for this type of molding. At least 28 motor car manufacturers, which represents practically the entire industry, have adopted these interior fittings for 1938. All together 230 different fittings have been counted on the 1938 cars. One of the most important of these uses, of course, is steering wheels. The Bakelite Co. is rounding out its line of plastics by offering a cellulose acetate plastic.

Large volumes of cellulose nitrate are still being used for many applications. The sheets, rods and tubes of nitrate amounted to 21,158,768 in 1937 and to 20,259,802 lb. in 1936 a 4 per cent increase. Prices remain less than for acetate. One of the principal uses for the material is laminated glass. About 12 to 15 per cent of this product contains cellulose nitrate as sandwich material.

Mixed cellulose esters such as the aceto-propionate and aceto-butyrate are developing slowly, commercial use at present being confined to the protective coating field. Interest in aceto-butyrate has been stimulated by a Bureau of Standards report indicating very excellent resistance to weathering; this is of particular importance in aviation.

Ethyl Cellulose

Ethyl cellulose, now being produced by both Hercules Powder Co. and Dow Chemical Co., is a potential competitor of cellulose acetate in the molding applications, but because of certain limitations has not made much progress thus far. Ethyl and benzyl cellulose are imported by Advanced Solvents and Chemical Corp.

The polystyrene resins are not exactly newcomers for the Naugatuck Chemical Co. offered such a resin in 1930. It was most interesting because of the electrical characteristics. However, the product has failed to attract a large following. Recently Dow and Bakelite have entered the field.

Recently methods have been developed for producing the monomer on

U. S. Production and Sales of Synthetic Resins, 1936
(U. S. Tariff Commission)

	Production	Sales		
	Pounds	Pounds	Value	Unit value
	(A) Of Coal-Tar Origin			
Total†	116,334,635	85,285,926	$16,652,415	$0.20
Derived from:				
Phenol	50,635,448	48,125,099	9,015,339	.19
Phenol and cresols	7,281,807	3,690,595	1,019,560	.28
Cresols and xylenols	11,464,838	9,217,697	1,305,395	.14
Phthalic anhydride and maleic anhydride	46,952,452	24,252,535	5,312,121	.22
	(B) Of Non-Coal-Tar Origin*			
Total	15,611,041	14,766,640	3,591,467	.24

† Does not include resins derived from coumarone and indene, styrol, hydrocarbons and sulphonamides. * Includes resins derived from: abalyn-hydrogen-nitrogen abietic acid, acrylic acid esters, adipic acid, petroleum, terpenes, urea, urea and thiourea, vinyl compounds, and wood rosin-methyl alcohol.

a commercial scale at a cost that will make it more generally useful. At present prices are somewhat higher than for other resins, due to limited production but as facilities are increased to keep pace with the growing demand prices should be reduced.

Cast phenolic resins experienced a setback of about 10 per cent for the year. In 1936, the output was estimated to be 6,000,000 lb. Prices held steady at an average of about 43c. per lb. While the Catalin Corp. of America continued to be the principal factor in the field, Joanite, Bakelite, du Pont, Marblette and Fiberloid (acquisition of Fiberloid Corp. by Monsanto Chemical Co. is pending) are said to have produced some resin. Prior to 1937 the largest outlet for the cast resin was the decorative button trade, but last year buttons for ladies' garments and to a lesser extent for men's clothing were replaced by zippers. The use of the resin as an adhesive for laminated board was also reduced to some extent. However, the market for cast phenolic resin for novelties and other purposes held at or above the level of the previous year.

Urea-Formaldehyde Resins

Production of urea-formaldehyde molding resins reached a new high in 1937, in the neighborhood of 9,000,000 lb. (including filler). This compares with 7,000,000 lb. in 1936 and 6,200,000 lb. the previous year. The basic price has remained steady. There has been an increase in demand for these resins for laminating purposes. A noticeable growth in urea resins for small buttons on shirts has taken place. These resins have been used to some extent as an adhesive in the fabrication of plywood. But its greatest growth has been for treatment of textile fabrics, cotton, rayon, linen, for anti-crease and other purposes (fire proofing, sizing, water proofing, increasing weight and bulking, and reducing shrinkage and slippage). A special modification of these resins is coming into great prominence for surface coatings. The molding material continues to be in favor for lighting fixtures. Perhaps the largest of the new moldings was a 25-in. reflector made in General Electric's new plastics molding plant (said to be the largest in the world) at No. 1 Plastics Ave., Pittsfield, Mass.

Early in 1936, announcement was made of the use of Vinylite X with a plasticizer in making a plastic sheet for safety glass. This was a joint development at Mellon Institute of Carbide & Carbon Chemicals Corp. and the Pittsburgh Plate Glass Co. At present plants are under construction for the production of polyvinyl acetal by Shawinigan, Inc., at Indian Orchard, Mass. and by E. I. du Pont de Nemours & Co. at Arlington, N. J. Due to greater elasticity at low temperatures and other characteristics, it promises to cut into the cellulose acetate and cellulose nitrate markets for the sandwich material in safety glass.

There are two producers of acrylic resins in this country, duPont and Rohm & Haas. This material is still so new that it is feeling its way along. It is not only available in the water-white variety but in many colors. A polymerized derivative of methacrylic acid is also available as a cast resin in the form of sheets, rods and tubes, and as a thermoplastic molding powder. It can be obtained in both forms as a crystal-clear product and in a wide variety of brilliant transparent, translucent and opaque colors. The powder can be adapted to either compression or injection molding.

One of the most interesting developments announced during the year is the plastic wood of the Masonite Corp. Except for a film of synthetic resin on the two surfaces and a small amount of dyestuff this product is 100 per cent wood. It is available in two grades: the uncured material is known as Benaloid and the cured material as Benalite. This product is too new yet to have found its place in industry. However, since the density is the same as the ultimate density of wood it is non-compressible and this together with its high water resistance and electrical characteristics makes it a most attractive, low-cost plastic.

Volume of Plastics Exported Is Growing

The plastics industry of the United States which has made such rapid progress in recent years is now devoting renewed attention to the export field, and, according to the Commerce Department's Chemical Division, is making rapid headway. American plastic materials as well as products with plastic bases are now known the world over for their superior and dependable qualities.

United States exports of plastic materials, for use abroad mainly in the manufacture or fabrication of a thousand and one products, aggregated 9,500,000 lb. valued at $3,413,000 in the first half of 1937 against 6,245,000 lb. valued at $2,248,000 in the corresponding months of 1936, a gain more than 50 per cent both in quantity and in value, according to preliminary statistics. Export trade in a number of the items included in this group was developed in more recent years.

Pyroxylin plastic film support, also known as celluloid film base, led the export list in this group with shipments aggregating 1,985,600 lb. valued at $1,681,000 in the first half of the year which compares with exports of 1,186,000 lb. valued at $1,073,000 in the corresponding months of 1936. While exports of this product are well distributed the bulk goes to the United Kingdom, Canada, and Japan, statistics indicate.

Other items in the group recording gains in the first half of 1937 compared with the corresponding months of last year, included synthetic gums and resins, shipments of which increased from 2,024,000 to 3,071,000 lb.; film scrap, from 673,300 to 1,561,600 lb.; pyroxylin sheets, rods and tubes, from 365,000 to 385,000 lb.; cellulose acetate, sheets, rods and tubes, from 202,000 to 530,000 lb.; nitro and aceto cellulose solutions, collodions, etc., from 514,000 to 639,000 lb.; and the same materials not in solution from 1,280,600 to 1,329,000 lb.; according to preliminary statistics.

While not included in the above group it is interesting to note that the United States exported 986,000 gal. of pyroxylin base lacquers valued at $1,442,000 in the first half of this year which compares with similar shipments totalling 791,000 gal. valued at $1,153,500 in the corresponding months of 1936, according to Commerce Department records.

Production of Solvents Continued Upward Trend Last Year

PRODUCTION of solvents in general continued on an upward trend last year with total output increasing from 10 to 15 per cent over that for 1936. The larger output was due in part to increased demand from the lacquer and other consuming industries over the greater part of the year and to the fact that there was a shortage of some offerings, notably butyl acetate and alcohol at the close of 1936. Therefore the early 1937 deliveries represented some sales made in 1936 on which shipments had been deferred because of the scarcity of producer stocks.

While weakness in a few selections was noted at times, the general price situation showed a marked improvement over the conditions which prevailed in the years immediately preceding.

Ethyl Alcohol

Industrial alcohol plants operated on a wider scale last year with production of ethyl alcohol reported in excess of 215 million proof gallons which represented an increase of more than 9 per cent over the 1936 total. Production of denatured alcohol for the greater part of the year ran ahead of the corresponding period of 1936 but the December output fell considerably below the December 1936 figure and a slight loss was recorded for 1937. As stocks in hands of producers and bonded dealers were lower on Dec. 31, 1937, than on the corresponding day of 1936, a slight gain is indicated for consumption of denatured alcohol in 1937.

Prices for denatured alcohol were marked up early in the year and held a steady price course throughout the following months. Price-cutting competition was lacking and the firmness of the market was justified by higher costs for all raw materials, especially molasses and steel drums. The market also was strengthened by the retirement of one of the newer producers and by the sale of the industrial alcohol business of a prominent producing company to another already active in the field, thus reducing the number of competing companies. One of the large plants was thrown out of production for a while early in the year and consuming demand began to improve at a time when the supply was curtailed. In fact, some producers are reported to have bought in the open market in order to obtain stocks for delivery against existing orders.

The anti-freeze market also was more stable in price than it had been in preceding years. The opening quotation for C. D. alcohol anti-freeze worked out at a higher delivered cost than some premium alcohols and after a price adjustment to correct this situation, the market was maintained over the remainder of the year on an unusually steady level. Straight C. D. alcohol has been losing ground in sales for anti-freeze purposes with larger sales reported for the premium alcohols. It is estimated that sales of 188 proof C. D. alcohol for anti-freeze last year amounted to approximately 12,000,000 gal., of permanent anti-freeze, 6,000,000 gal., and methanol base anti-freeze, 12,000,000 gal.

During the fiscal year ended June 30, 1937, production of ethyl alcohol amounted to 223,181,228 pf. gal., compared with 196,126,236 pf. gal. produced in 1936, and 180,645,920 pf. gal. produced in 1935. The 1937 production exceeded the largest previous figure, 202,616,750 pf. gal. in 1929, by about 10 per cent.

Withdrawals were 7,960,405 pf. gal. less than production and amounted to 215,220,823 pf. gal., compared with 199,938,800 pf. gal. in 1936, 183,095,759 pf. gal. in 1935, and 191,376,549 pf. gal. in 1929.

An analysis of withdrawals in 1937 shows that 32,289,650 pf. gal. were withdrawn upon payment of tax, and 182,931,173 pf. gal. were withdrawn tax-free. Tax-free withdrawals were for the following purposes: 179,324,373 pf. gal. for denaturation, 1,764,740 pf. gal. for hospital and scientific use, 1,041,828 pf. gal. for use of the United States and subdivisions, 163,156 pf. gal. for export, and 637,076 pf. gal. for medicinal, beverage, and other authorized uses in Puerto Rico.

Withdrawals of ethyl alcohol on payment of tax in the fiscal year 1937 amounted to 32,289,650 pf. gal., an increase of 8,237,118 pf. gal. over the previous fiscal year. Withdrawals for tax-free purposes amounted to 182,931,173 pf. gal., an increase of 7,044,905 pf. gal. over 1936 and 16,826,386 pf. gal. over 1935.

Three new alcohol plants began operations in the 1937 fiscal year, one each in Indiana, Louisiana, and Washington and in addition, one each in Illinois, Indiana and Louisiana, resumed operations. One experimental plant began operations in New Jersey. Two plants which had operated in 1936 were discontinued and three others suspended operations in 1937.

Production of denatured alcohol amounted to 102,202,659 wi. gal. in the fiscal year 1937, compared with 101,477,843 wi. gal. produced in 1936, and 97,031,074 wi. gal. in 1935.

Withdrawals in 1937 amounted to 103,165,980 wi. gal. compared with 100,519,677 wi. gal. in 1936, and 96,-

Operations at Ethyl Alcohol Plants

Fiscal Years 1936-1937

	Proof Gal. 1937	1936
Production	223,181,228	196,126,236
Removed to bonded warehouses	222,828,218	195,981,119
Withdrawals, total	215,220,823	199,938,800
Tax-paid	32,289,650	24,052,532
Tax-free, total	182,931,173	175,886,268
For denaturation	179,324,373	172,478,748
For hospital and scientific use	1,764,740	1,565,114
For use of U. S. and subdivisions	1,041,828	993,734
For export	163,156	135,498
For medicinal and beverage use in Puerto Rico	637,076	713,174
Losses in warehouses	528,194	438,851
Losses in transit	39,871	47,877
Stocks, in bond, June 30	28,464,541	21,300,340
Materials Used		
Molasses, gal	202,631,056	173,385,873
Grain		
Corn, lb	198,467,734	141,068,809
Malt, lb	29,247,273	25,998,368
Rye, lb	4,598,838	15,280,971
Other, lb	344,162	2,744
Ethyl sulphate, gal	25,492,675	24,402,700
Sulphite liquor, gal	12,060,125	7,396,855
Pineapple juice, gal	3,598,222	6,789,672
Cider, gal	34,820	.....
Corn sirup, gal	28,446	94,282
Fermented liquor, gal	23,157	589,806
Manioca meal, lb	634,552	.....
Hydrol, lb	.....	402,379
Miscellaneous, lb	58,845	23,151

703,993 wi. gal. in 1935. Withdrawals in 1937 consisted of 79,681,876 wi. gal. of specially denatured alcohol, and 23,484,104 wi. gal. of completely denatured alcohol, the former representing an increase of 14,862,391 wi. gal., and the latter a decrease of 12,216,088 wi. gal., compared with 1936. Specially denatured alcohol constituted 77.2 per cent of the total withdrawals of denatured alcohol in 1937, compared with 64.5 per cent in 1936, and 60.6 per cent in 1935.

The number of denaturing plants operated increased from 37 in 1936 to 45 in 1937. The number of bonded users of specially denatured alcohol operating increased from 4,267 in 1936 to 4,323 in 1937; and the amount of denatured alcohol used (including the amount recovered and reused) increased from 109,525,613 wi.gal. in 1936 to 139,054,515 wi.gal.

Methanol

The outstanding feature to the methanol market was the sharp rise in the output of the synthetic grade which made an all-time record. Crude methanol production also was higher than in recent years. The rise in manufacture of plastics has enlarged demand for methanol and other consuming industries, including anti-freeze, took on larger amounts last year but lack of statistics regarding stocks makes it difficult to determine whether or not there was a balance between production and consumption.

Early in the year prices for synthetic methanol were lowered but this was regarded as an equalization of special prices following the going into effect of the Robinson-Patman Bill. Later, one producer who had accumulated stocks of denaturing grade made a reduction of 5 cents a gallon in that grade and this reduction was met by other producers. With these exceptions sales prices were firmly maintained over the year.

Acetone

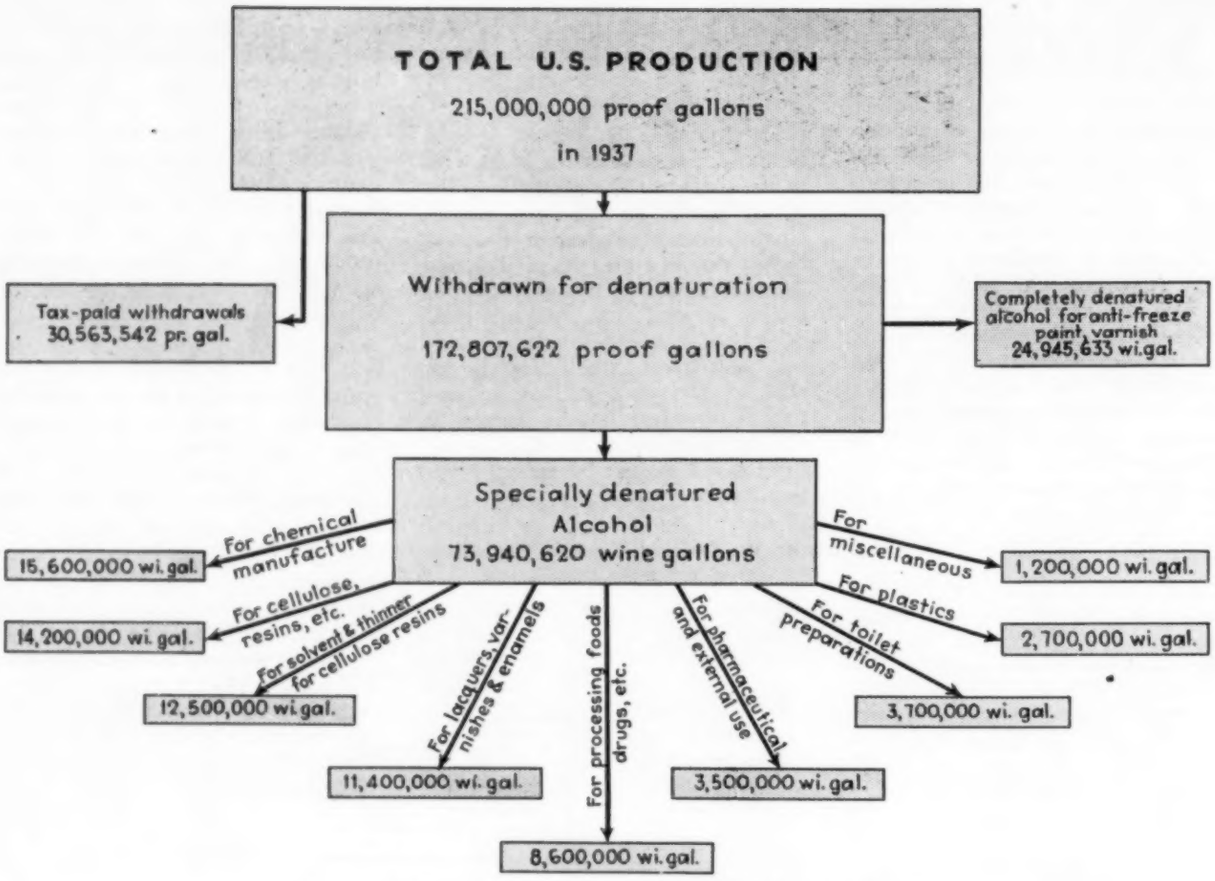
Acetone offers an exception to the position of solvents in general as it held a weak price position throughout the year. The market was on a downward trend in 1936 and this

Statistics on the Uses of Specially Denatured Alcohol[1]

Fiscal year ended June 30, 1936.

Product or use	Number of permittees	Amount used including re-used (wine gallons)	[2] Per cent re-used
Cellulose, resin, and related products:			
Lacquers, varnishes, and enamels:			
Cellulose	118	4,281,605	12
Synthetic resins (containing no cellulose compounds)	21	455,834	.....
Shellac (containing no cellulose or synthetic resins)	447	3,410,540	2
Other natural resins (containing no cellulose, synthetic resin, or shellac)	119	1,120,455	.....
Coatings exclusively from other materials	10	38,740	.....
Total lacquers, varnishes, and enamels	707 [3]	9,307,174	7
Plastics:			
Cellulose compounds	13	4,744,577	69
All other plastics (containing no cellulose)	13	722,270	2
Total plastics	26 [3]	5,466,847	60
Photographic film (including emulsions)	47	1,221,384	72
Explosives	7	411,562	77
Polishes	63	254,345	.....
Adhesives	51	211,516	2
Soldering flux	57	122,787	.....
Inks, stains, and dye solutions (containing no cellulose or resin)	128	108,864	.....
Miscellaneous cellulose or resin solutions	47	41,651	.....
Total cellulose, resin and related products	857 [3]	17,146,130	30
Solvents and thinners for cellulose and resin products:			
Proprietary solvents	30	9,212,266	.....
Other industrial thinners	72	1,344,463	.....
Total solvents and thinners	97 [3]	10,556,729	.....
Processing industrial, food, drug, and other products:			
Dehydrated nitrocellulose	8	10,805,203	80
Petroleum oils	10	2,744,932	92
Pectin	6	4,717,550	97
Other food products	22	255,145	77
Drug products	162	5,281,064	83
Sodium hydrosulphite	4	909,592	80
Dyes and intermediates	14	561,017	59
Other chemicals	20	1,462,122 [4]	9
Miscellaneous products	28	387,807	76
Total processing industrial, food, drug, and other products	246 [3]	27,124,432	81
Pharmaceutical products for external use:			
Products manufactured in accordance with formulae of the U. S. P. or N. F.	124	254,021	.....
Tincture of iodine	51	80,306	.....
Rubbing alcohol	310	2,851,727	.....
Other preparations for external use	451	191,455	.....
Total pharmaceutical products	709 [3]	3,377,509	.....
Toilet preparations and related products:			
Hair and scalp preparations, exclusive of shampoos	930	906,288	.....
Shampoos	173	161,653	.....
Bay rum	338	256,354	.....
Other face and hand lotions	778	452,127	.....
Toilet waters	628	545,547	.....
Perfume and perfume tinctures	492	173,749	.....
Toilet soaps (including shaving cream)	78	102,837	.....
Mouth washes	351	645,009	.....
Tooth pastes and powders	39	61,360	.....
Total toilet preparations	1,765 [3]	3,304,924	.....
Cleaning, preserving, and flavoring preparations:			
Tobacco sprays and flavors	104	1,451,082	.....
Cleaning preparations (including cleaning operations)	213	263,779	15
Deodorant sprays (non-body)	110	78,237	.....
Disinfectants, insecticides, etc.	103	37,201	.....
Embalming fluids	34	31,350	.....
Sterilising and preserving solutions	48	25,505	.....
Industrial soaps	18	11,095	.....
Total cleaning, preserving, and flavoring solutions	598 [3]	1,898,249	2
Converted as a raw material in chemical manufacturing:			
Vinegar	35	5,789,043	.....
Ethyl acetate	11	6,957,907	3
Ethyl chloride	4	5,975,198	.....
Other ethyl esters	37	553,191	48
Dyes and intermediates	8	644,555	35
Aldehydes	5	16,650,777	65
Ethyl ether (sulphuric ether)	8	658,990	11
Other ethers	5	6,256,479	91
Ethylene dibromide	2	436,602	.....
Ethylene gas	5	420,847	4
Xanthates	3	307,683	.....
Acetone	2	278,377	47
Fulminate of mercury	6	166,634	11
Miscellaneous	21	161,782	51
Total converted in chemical manufacturing	130 [3]	45,258,065	39
Fluid uses:			
Brake fluids	7	233,130	.....
Cutting oils	7	22,228	.....
Other fluid uses (including door checks)	56	33,551	.....
Total fluid uses	70 [3]	288,909	.....
Fuels	8	67,275	.....
Laboratory and experimental uses	1,129	111,619	.....
Grand total	4,267 [5]	109,133,841	41

[1] Includes specially denatured rum.
[2] Includes amounts re-used after recovery where the alcohol has not become a part of the finished product.
[3] Represents number of permittees operating within each major grouping.
[4] Includes the use by one manufacturer in the production of a denaturant for completely denatured alcohol.
[5] Represents actual number of permittees operating.



Chem. & Met. **Estimate for Ethyl Alcohol Distribution in 1937**

condition was intensified last year. The year opened with about 70 per cent of the consuming market under long term contracts to two producers. Other producers found it difficult to find a receptive outlet for their production. Practically the same situation had existed in 1936 and led to lowering of prices on less than carlot quantities and to low priced sales in the export trade. In 1937 many foreign countries increased their own outputs and cut down importations. Two new producers entered production in the domestic field in 1937 and further complicated matters. Late in the year one of these producers who had operated on a semi-commercial scale stopped producing.

Before the end of the year, one of the large producers accepted a government bid at a very low price and shortly afterwards synthetic producers offered tank car lots on a basis of 4¾¢ a lb. which was the lowest price ever named for acetone.

The market for butyl alcohol and acetate was better in 1937 than it was in 1936, which reflected a general increase in business. Also the demand was increased, due to the shortage of glycerine-phthalic anhydride during the first half of the year, as well as China wood oil, which restricted the growth of resins and resin varnishes, if it did not actually curtail them.

Prices were raised as of the first of the year and continued firm throughout as a number of times during the year the question of receiving butyl alcohol-butyl acetate was more important than the price paid for it.

Other factors contributing to firmness in the market are the facts that one producer who did a considerable amount of distress selling in 1936, made a sizable export commitment at a very low price during 1937. When he encountered manufacturing difficulties, he was forced to buy on the open market at prices higher than those received on the export commitment.

The butyl situation was also helped by the fact that of the two amyl producers, one practically discontinued the sale of amyl acetate and the other received an unexpectedly large amount of business from a large consumer who had formerly advised that they would be self-sustained in their high boiler requirements during 1937.

The price of ethyl acetate was raised at the beginning of the year and the demand for ethyl acetate was relatively good, due to an increased demand for artificial leather and the fact that one large company who produces the ethyl acetate it consumes was forced to go on the open market for its requirements.

At the end of the year, however, when the demand slowed down due to the general business conditions, one producer, worried about an affiliated company's acetic acid position coupled with a dispute with a competitor, reduced the price of ethyl acetate one cent per pound, and the present prices barely cover the cost of raw materials.

Rayon Production Up While Consumption Lags

EDITORIAL STAFF

DURING the first eight months of 1937, rayon was consumed at a higher rate than ever before. Then, in September, deliveries dropped to 80 per cent of the previous monthly average for the year, followed by still slower deliveries each succeeding month until, in December, they had fallen to only a third of the earlier rate. While this was occurring, however, there was little if any slackening in the rate of production, with the result that for the 14th time in the last 16 years, another production record was broken. Consumption for the year was greater than at any time with the exception of 1936, but it did drop 12 per cent below that year, while production was increasing by approximately the same percentage. Consequently the industry now finds itself with stocks considerably larger on a tonnage basis than at any time in the past, although they represent but a 2½ month's supply at current levels, which is by no means as high as was customary prior to 1933.

Domestic Record

Production in 1937 totaled 312,236,000 lb. of filament yarns, a gain of 12.5 per cent over the 277,626,000 lb. of 1936, according to the official statistics of the industry recently issued by *Rayon Organon*. Taking into consideration domestic shipments and foreign trade, this agency has determined that consumption was apparently 261,195,000 lb., compared with the 297,594,000 lb. taken by users in 1936. Of this production, 76.3 per cent or 238,191,000 lb. was viscose plus cuprammonium yarn (of which we believe about 10,000,000 lb. was cupra) and 74,045,000 lb. was acetate rayon. In 1936 the corresponding percentages were 77.4 and 22.6—evidence of the continuing trend toward a greater percentage gain for acetate, a trend which first became marked in 1933.

The figures previously given do not include staple fiber which has been increasing at a rate considerably over 100 per cent per year since 1932. Production of this material reached 20,100,000 lb. in 1937 according to the *Organon*, while imports were high enough to bring consumption over 40,000,000 lb., or nearly as large as the total rayon consumption as recently as 1925. Staple continues to be the sensation of the industry, with rapidly increasing use in a wide variety of applications.

Rayon Production and Imports, 1921-1937

	Thousands of Pounds		
	U. S.* Production	U. S.† Imports	World* Production
1921.....	18,000	3,276	65,000
1922.....	26,000	2,116	80,000
1923.....	35,000	3,029	97,000
1924.....	38,750	1,954	141,000
1925.....	52,200	5,441	185,000
1926.....	62,575	9,345	219,000
1927.....	75,050	15,034	267,000
1928.....	97,700	12,144	345,000
1929.....	121,399†	15,055	404,000
1930.....	127,333†	6,340	417,000
1931.....	150,879†	1,804	470,000
1932.....	134,670†	197	509,000
1933.....	213,498†	934	660,000
1934.....	208,321†	77	799,589
1935.....	257,557†	26	932,780
1936.....	277,626†	248	1,006,000†
1937.....	312,236† (est.)	860	1,125,000†

* From *Textile World* except as noted; does not include staple.

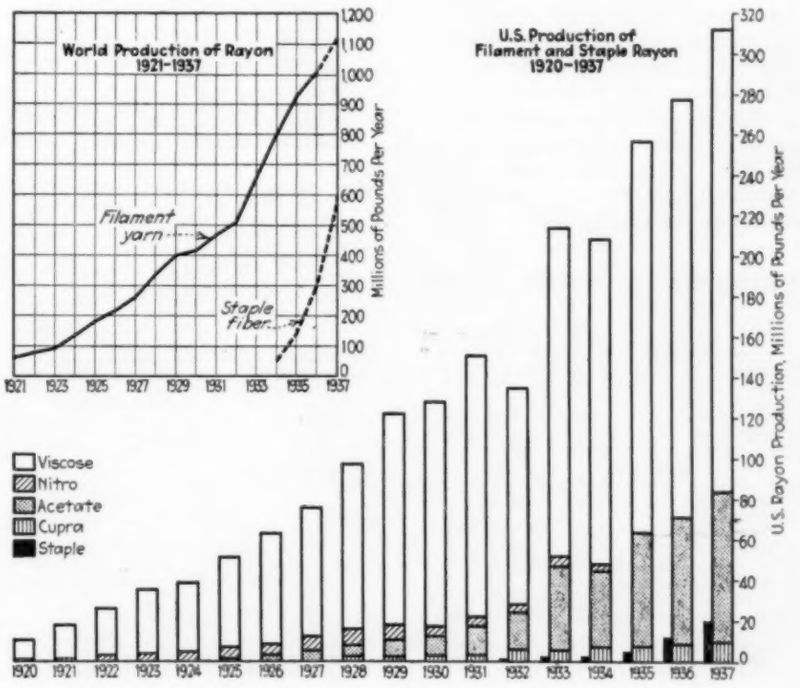
† From *Rayon Organon*. Does not include staple which is estimated at 350,000 lb. in 1930; 880,000 lb. in 1931; 1,100,000 lb. in 1932; 2,100,000 lb. in 1933; 2,200,000 lb. in 1934; 4,600,000 lb. in 1935; 12,300,000 lb. in 1936; and 20,100,000 in 1937. World staple estimated at 6,100,000 lb. in 1930; 52,700,000 lb. in 1934; 139,900,000 lb. in 1935; 299,000,000 lb. in 1936; and 600,000,000 lb. in 1937. Imports to 1930 cover yarns, threads and filaments; since 1930 yarns, single and plied.

New World Peaks

As did domestic production, world output also reached new high levels, with a total of 1,125,000,000 lb. of filament yarns, and 600,000,000 lb. of staple according to preliminary estimates. Only Japan passed the United States production of filament yarn, with a probable production in the neighborhood of 325,000,000 lb. Japan had very nearly reached U.S. filament levels in 1936, and including staple, had passed it considerably. With a probable staple output of 175,000,000 lb. in 1937, Japan was by far the largest producer of synthetic fibers.

During the year interest in new rayon pulp sources was active (see McIndoe, *Chem. & Met.*, Jan., 1938, p. 12), while speculation was rife concerning the imminent commercialization of Industrial Rayon's viscose modification of the continuous Furness process for filament spinning. Rumors of new filament yarn materials continue and at least

(Please turn to page 101)



Coke and Gas in 1937

DESPITE the sharp slump in metallurgical operations during the last quarter of the year, the production of coke and other coal products was higher during 1937 than in any previous post-depression period. During several of the earlier months the daily average output at byproduct and beehive ovens exceeded any corresponding figures since the boom years of the late 20's. At the peak of the year's activity there were 85 plants making coke, of which 81 recovered ammonia and 56 recovered crude light oil.

Significant figures for the operations of 1937 were as follows (data from U. S. Bureau of Mines):

Coal carbonized:
In beehive ovens..... 5 million tons
In byproduct ovens.....70 million tons
Coke produced:
In beehive ovens..... 3 million tons
In byproduct ovens.....49 million tons

Recovery of byproducts during the year is estimated as follows on the basis of the typical ratio of these products to the coal used:

Gas.....770 million cu. ft.
Tar.....640 million gal.
Ammonium sulphate (equivalent) 770 million lb.
Crude light oil.....190 million gal.
Naphthalene.....40 million lb.

It will be noted that the byproduct oven output last year exceeded by about 10 per cent the 1936 production. And the beehive output was the largest in any post-depression year. The combined output of beehive and byproduct coke—in excess of 52 million tons—approximately equalled boom-year averages of the late 20's. It was significantly lower, however, than the peak production during that earlier period.

Because of the recession in metallurgical activity, there began in October a sharp curtailment in operation of coke plants, especially those directly associated with blast furnace enterprises. Despite this cutting back of operations carried out as quickly as possible, stocks of coke built up slightly toward the end of the year. Bureau of Mines estimates indicate that stocks at byproduct plants were approximately 8 per cent higher at the end of 1937 than a year before. Moreover, increases were slightly greater at metallurgical plant ovens than at merchant plants.

During 1937 several new coke oven batteries were put into operation, notably those of the Ford Motor Co. at Dearborn. At the end of the year several new batteries were under construction, practically all replacement or increased-capacity units for blast-furnace plants. Increase in ovens for city-gas supply has been practically negligible during the last few years because of the great increase in the use of natural gas for city distribution. Even those utility enterprises remote from natural gas supplies have been hesitant about such expenditures, partly because of the threat of natural gas transmission for long distances, and partly because of the difficulty of financing new utility plants under prevailing political conditions.

The city gas industry during 1937 served more customers than at any time during its previous history. In total, it reached communities with a population of 80 million persons, including over 17 million customers. Revenues of the industry exceeded $800,000,000, a gain of 4 per cent over the preceding year. Outstanding increases in sales were made for house heating; and the use of ap-

Manufactured Gas Industry for 1937

Customers	1937 (Add 000's)	1936 (Add 000's)	Per cent change
Domestic	9,296	9,062	+ 2.6
House heating	207	172	+20.3
Industrial and Commercial	464	460	+ 0.9
Miscellaneous	9	9	—
Total	9,976	9,704	+ 2.8
Gas Sales (MCF)			
Domestic	195,077	198,199	— 1.6
House heating	44,936	41,226	+ 9.0
Industrial and Commercial	113,227	101,640	+11.4
Miscellaneous	2,241	2,197	—
Total	355,481	343,262	+ 3.6
Revenue (Dollars)			
Domestic	256,818	258,924	— 0.8
House heating	28,173	26,207	+ 7.5
Industrial and Commercial	74,286	70,884	+ 4.8
Miscellaneous	1,478	1,516	—
Total	360,755	357,531	+ 0.9

Natural Gas Industry for 1937

Customers	1937 (Add 000's)	1936 (Add 000's)	Per cent change
Domestic (incl. house heating)	6,502	6,277	+ 3.6
Commercial	502	487	+ 3.1
Industrial	42	37	+13.5
Total	7,046	6,801	+ 3.6
Gas Sales (MCF)			
Domestic (incl. house heating)	362,021	343,473	+ 5.4
Commercial	103,933	97,590	+ 6.5
Industrial	870,909	789,582	+10.3
Total	1,336,863	1,230,645	+ 8.6
Revenue (Dollars)			
Domestic (incl. house heating)	246,932	236,979	+ 4.2
Commercial	48,251	46,306	+ 4.2
Industrial	145,993	129,426	+12.8
Total	441,176	412,711	+ 6.9

Coke-Oven Byproducts, 1936

(Minerals Year Book, 1937)

	Production	Sales	Value of Sales
Tar.....gal.	560,385,578	358,182,759	$15,328,340
Ammonia:			
Sulphate.....lb.	1,199,645,603	1,123,343,067	11,484,191
Ammonia liquor (NH_3 content).....do	47,259,245	46,907,237	1,328,788
Sulphate equivalent of all forms.....do	1,388,682,583	1,310,972,015	.....
Gas:			
Used under boilers, etc.....M cu. ft.	[2]699,701,415	28,807,618	1,764,469
Used in steel or affiliated plants.....do		226,229,045	21,717,052
Distributed through city mains.....do		156,063,794	44,711,670
Sold for industrial use.....do		22,538,584	2,637,779
		433,639,041	70,830,970
Light oil and derivatives:			
Crude light oil.....gal.	[3]170,234,202	10,363,176	971,764
Benzol, crude and refined.....do	19,412,593	19,145,088	2,675,932
Motor benzol.....do	85,672,953	84,761,655	7,628,935
Toluol, crude and refined.....do	19,807,383	19,695,792	5,401,424
Solvent naphtha.....do	5,189,232	4,961,433	916,505
Xylol.....do	4,216,081	4,206,525	1,121,032
Other light-oil products.....do	6,673,992	3,523,836	221,185
	[4]140,972,234	146,657,505	18,938,777
Naphthalene, crude and refined.....lb.	37,552,219	34,946,890	570,295
Tar derivatives:			
Creosote oil, distillate as such.....gal.	16,052,953	10,418,339	939,989
Creosote oil in coal-tar solution.....do	2,116,481	1,219,983	111,753
Pitch of tar.....net tons	68,339	4,372	33,127
Other tar derivatives.....	.....	.....	417,966
Phenol.....gal.	75,612	74,160	27,116
Sodium phenolate.....do	162,334	168,145	12,730
Other products[5].....	.....	.....	181,581
			$120,205,633

[1] Includes products of tar distillation conducted by coke-oven operators under same corporate name, except, however, phenol and other tar acids produced at Clairton, Pa.
[2] Includes gas wasted and gas used for heating retorts.
[3] Refined on the premises to make the derived products shown, 163,990,960 gal.
[4] Total gallons of derived products.
[5] Ammonia thiocyanate, asphalt paint, carbolates, cyanamide crystals, cyanogen sludge, ferrocyanide, insecticides, light carbolic oils, pyridine oil, sodium prussiate, spent soda solution, sulphur, and vented vapors.
[6] Exclusive of the value of breeze production, which in 1936 amounted to $7,265,615.

proximately 170 billion cu. ft. of natural gas for generating electric power constituted an all-time record.

Aggressive merchandising policies of the industry led to the sale of nearly 1,600,000 gas ranges, a figure equaling the previous record established in 1929. Industrial gas burning equipment also was sold in unprecedented quantity. It is estimated by the American Gas Association that at the beginning of 1938 more than 2,000,000 homes are heated by gas, about 735,000 of these being served by gas-fired central-heating furnaces.

The increase in sales of both manufactured and natural gas for industrial and commercial purposes was about 10 per cent above 1936. Household sales of natural gas also increased, as did house heating and water heating sales of manufactured gas. But there appeared to be a small decline—about 1.6 per cent—in the household use of manufactured gas for cooking, refrigeration, and miscellaneous purposes.

Organic Chemicals Continue Climb

FOR THE fifth consecutive year production of organic chemicals has climbed to a new all-time peak. Preliminary estimates indicate that the 1937 figure for coal-tar and non-coal-tar products combined will exceed 1936 by approximately 10 per cent. This increase is considerable in view of the general falling-off of manufacturing during the latter months of the year, and shows up now only as the result of record buying on the part of the large consuming industries such as plastics, paints and rayon during the spring and early summer. New organic chemicals introduced in 1937 were largely along specialty lines and did not contribute noticeably to the production increase.

The current situation in the industry as a whole is in keeping with general conditions. Estimates of individuals in close contact with producers put present production in all lines at a point definitely below seminormal and estimate average inventories to be close to 3 months ahead at the current rate of consumption. Furthermore, the outlook for the coming year can hardly be termed promising.

Coal-Tar Products

A projection through September, 1937, of the previous year's rate of production increase in both coal-tar crudes and finished products made it possible for these materials to show a substantial increase in their total for the year. One of the large tar distillers, in fact, carried on at full capacity continuously through November before finding it necessary in the final month of the year to make a cut of 50 per cent in production schedule. This suddenness of curtailment seems to be characteristic of the way the recession struck in several chemical lines.

Among coal-tar crudes, benzol as currently reported by the Bureau of Mines showed a 15 per cent gain over 1936 in reaching its 1937 peak of 116,000,000 lb. Toluol, reflecting the decline in automobile operations, dropped off considerably during the latter part of the year. This coal-tar solvent, along with xylol and solvent naphtha, is also beginning to feel the growing competition from petroleum products, particularly those of the recently developed "high solvency naphtha" type.

The naphthalene situation was easier in 1937 after the previous year's excessive demand resulting from the sudden spurt in alkyd resins. Made from glycerine and the naphthalene derivative, phthalic anhydride, alkyd resins increased naphthalene consumption from 100,000,000 lb. in 1935 to 125,000,000 lb. in 1936. This record in itself was outstanding, but still more remarkable was the fact that it was reached during a year when imports, which since 1927 have supplied about half of our annual consumption of naphthalene, dropped off more than 20 per cent due to curtailment of the German supply. However, an average price increase of 19 per cent from 1935 to 1936 was sufficient incentive to boost domestic production 88 per cent over the same period, and so meet what appeared early in 1936 to be a rather distressing situation in the face of a new and rapidly expanding market. As a result of the alkyd resin demand, there has been a substantial increase in production capacity for phthalic anhydride in this country during the past year.

In 1937 naphthalene imports again came back to their old level as a result of the German decision that anthracene oil, rather than naphthalene, is a more suitable raw material for the carbon black process in which that country is interested at present. This use was reported to

Production and Sales of Dyes and Organic Chemicals

(Data from U. S. Tariff Commission)

	1925–30 average	1935	1936	Increase 1936 over 1935 per cent
Coal-tar intermediates:				
Production, 1,000 lb.	267,492	436,656	509,706	16.7
Sales, 1,000 lb.	109,133	190,917	223,119	16.9
Sales value, $1,000	22,408	26,074	31,806	22.0
Finished coal-tar products:[1]				
Production, 1,000 lb.	138,078	[2] 272,728	[3] 335,091	22.9
Sales, 1,000 lb.	133,964	[2] 230,381	[3] 286,033	24.1
Sales value, $1,000	65,027	[3] 98,792	[3] 119,498	20.5
Dyes—				
Production, 1,000 lb.	94,003	101,933	119,233	17.0
Sales, 1,000 lb.	92,207	97,954	117,256	19.7
Sales value, $1,000	39,428	51,488	62,822	22.0
Medicinals—				
Production, 1,000 lb.	4,508	10,023	12,034	20.0
Sales, 1,000 lb.	4,106	8,950	10,079	12.6
Sales value, $1,000	7,464	8,372	9,762	16.6
Flavors and perfume materials—				
Production, 1,000 lb.	3,966	4,364	3,481	[4] 20.2
Sales, 1,000 lb.	3,919	4,080	3,436	[4] 15.8
Sales value, $1,000	2,901	3,172	3,220	[4] 1.5
Coal-tar resins—				
Production, 1,000 lb.	[3] 24,442	[2] 90,913	[3] 116,334	28.0
Sales, 1,000 lb.	[3] 22,135	[2] 65,923	[3] 85,286	29.3
Sales value, $1,000	[3] 7,756	[2] 12,777	[3] 16,652	30.3
Non-coal-tar organic chemicals:				
Production, 1,000 lb.	379,972	1,591,896	2,041,454	28.2
Sales, 1,000 lb.	264,006	791,760	1,034,921	30.7
Sales value, $1,000	44,499	6,334	105,831	22.6

[1] Includes color lakes, rubber chemicals and miscellaneous coal-tar products not shown separately.
[2] Does not include coumarone and indene resins.
[3] Does not include resins derived from coumarone and indene, styrol, hydrocarbons and sulfonamides.
[4] Decrease. [5] 1927–30 average.

be the main reason for the German conservation of naphthalene in 1936. The total imports of naphthalene into the United States last year are reported to be 51,000,000 lb. Taking the estimate of one producer that total consumption for the year was approximately 110,000,000 lb., this leaves 59,000,000 lb. produced domestically as compared with 89,000,000 lb. in 1936.

Dyes and Medicinals

Based on textile mill activity, the apparent consumption of coal-tar dyes in 1937 was approximately the same as in 1936. Taking into consideration imports of 3,350,000 lb. and exports of 16,300,000 lb., domestic production last year is estimated at 118,000,000 lb. as compared with 119,000,000 lb. in 1936. A recent field of development which gives promise of opening a new market for dyes is that of the transparent plastics. At present, however, this outlet is relatively insignificant when compared with the volume of dyes going into textiles.

It is difficult to estimate the position of other special lines of coal-tar products such as medicinals and synthetic flavoring materials. Very generally, however, it may be said that for these lines 1937 was at least as good a year as 1936.

Chemicals from Petroleum

Research trends in the direction of catalytic processes have characterized the fast growing petroleum chemicals industry during 1937. It seems definitely established that the refiner is destined to become an organic chemicals manufacturer instead of remaining solely a producer of gasoline and lubricants. Already the economic advantage of petroleum synthetics has enabled these products to make substantial headway in certain coal-tar and wood chemicals fields. Some of the outstanding examples include resins such as cellulose acetate, alkyds, and methyl methacrylate; solvents and thinners such as toluol, glycol ethers, ethanolamines and high solvency naphthas; and miscellaneous items such as isopropyl alcohol, diphosgene, hydrocyanic acid and synthetic rubber.

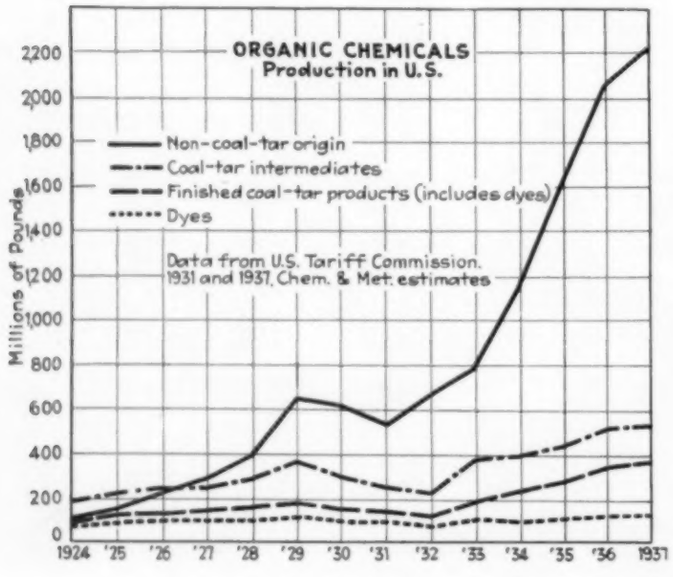
Evidence of the tremendous growth of this branch of the organic chemical industry is offered by the accompanying curve showing the progress of non-coal-tar synthetics since 1927. An increase of nearly 20 fold has taken place over this 11-year period.

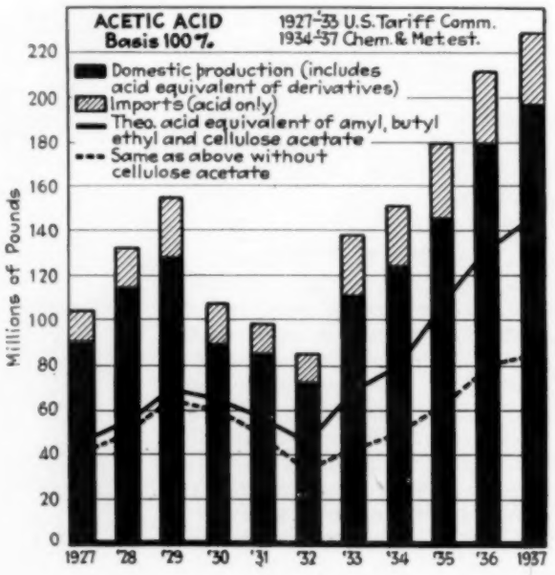
Acetic Acid

Since all acetate products are so closely interrelated in their production and may or may not be reported at the intermediate stage as acetic acid or acetic anhydride, it is necessary to consider all of them as a group when presenting any comparable production figures over a period of years. This is what has been done on the accompanying graph. The amounts shown represent both acetic acid produced as such and the acetic acid equivalent of derivatives made directly such as in the case of some acetic anhydride and ethyl acetate. The only major source of the acid not represented is vinegar, and since this is practically all for domestic consumption it is generally considered as a food item rather than an industrial chemical.

On the above basis, the estimated consumption of 100 per cent acetic acid in 1937 amounted to 229,000,000 lb. as compared with 212,000,000 lb. in 1936. The increase was almost entirely in synthetic production from acetylene, ethylene and propylene. One new synthetic producer entered the field in 1937 and at least two more concerns are considering similar moves in the near future. Calcium acetate from wood distillation is fast dropping out of the picture as a source of acetic acid. In spite of a large decrease in price and excessive current inventories, calcium acetate production last year dropped about 40 per cent from 1936. In the course of the year, four wood distillers changed over entirely or partly from the acetate to direct recovery of acid.

The chief consumers responsible for the rapid growth of acetic acid during the past few years have been cellulose acetate, both as molded-plastics and rayon, and acetate lacquer solvents, principally amyl, butyl and ethyl. To show how closely the acid trend has followed the growth of these important derivatives, their theoretical acid equivalent has been superimposed upon the accompanying acetic acid graph.





Dependence on Foreign Markets Stirs Search for Drying Oils

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THE SITUATION existing with regard to drying oils is best illustrated by two resolutions adopted within a few weeks of each other:

(1) At the convention of the National Paint, Varnish and Lacquer Association a resolution was adopted calling on the Federal Government for action to increase the planting of flax, the development of tung plantings in suitable climatic locations, the production of perilla and Mexican chici oils and the development of improved strains of the soybean.

(2) On November 19, 1937 at a meeting of the Flax Development Committee of the Flax Institute, a resolution was adopted to encourage by constructive propaganda the planting of an increased area to flax where soil and climate were suitable. Also to develop for commercial use strains of flaxseed giving an increased percentage of oil and higher iodine absorption numbers. Also that the situation be brought to the attention of the Department of Agriculture and the Government be requested to lend such assistance as it could appropriately render.

These resolutions direct attention to the dependence of this country upon imported seed for its supply of linseed oil. The 1937 domestic flaxseed crop is estimated at 6,974,000 bu. which makes it necessary to import about five times that amount if an active demand for linseed oil should arise in the current year.

The situation in tung oil is rather a puzzle when considering the imports for the first eleven months of 1937. The Bureau of Foreign and Domestic Commerce reports receipts of 169,708,751 pounds for the first eleven months of the year whereas the same department in the Tung Oil Monthly shows total shipments from Hankow as of Nov. 30 and consigned to the U. S. A. as only 110,952,000 pounds and the total shipments from that port as only 148,414,000 pounds. This means that a considerable amount of oil came through Canton and Hongkong in addition to the shipments by rail from Hankow. In addition to shipments from China, receipts are also reported from London and Rotterdam.

At the end of November, Hankow stocks were estimated at 9,000 tons with 5,000 tons on the river between Hankow and Shanghai and 2,500 tons on the river above Hankow.

Stocks in this country are the highest in years, the Department of Commerce estimating the stocks on hand at the beginning of November as 60,000,000 pounds which, at the end of the year, had dropped to 48,000,000 pounds or a sufficient supply to last through the first four or five months of this year.

Under existing conditions, shipments from China may be irregular and domestic production for 1938 will afford no relief as due to a late frost while trees were in bud or bloom, there was no crop West of Tallahassee, Florida, and the Florida crop was damaged about 25 per cent.

With regard to increased domestic production of tung oil, it has been shown very conclusively that these late frosts constitute the greatest hazard to the domestic industry. This may be explained by comparing the normal mean temperature of the tung oil belt in China with a station in this country such as Gainesville, Fla. Taking the average normal mean temperature of Shasi, Ichang and Changsha for the dormant months as compared with Gainesville, Florida, we have the following:

	Chinese Average	Gainesville	Difference
September	75.8	79.1	3.3
October	65.9	71.8	5.9
November	54.9	63.0	8.1
December	44.3	57.1	12.8
January	41.9	57.2	15.3
February	43.9	58.8	14.9
March	51.3	64.6	13.3
April	62.2	69.6	7.4

The above figures would indicate that the trees in China go dormant earlier and much more completely than in this country and hence there is not the danger of early blooming.

Since the tung oil plant at Gainesville began operations in 1932 there was practically no crop in 1933 and 1935 and the output from the 1937 crop will probably not reach a million pounds. Examining the detailed weather records for those years we find plus departures from the average as high as 11.6 at Gainesville in 1937. This comparison is probably accentuated by the fact that our domestic plantings are in the Gulf Coast States and at a low elevation while the Chinese trees are inland and at a higher elevation. Any future development in this country must be in localities with the minimum climatic hazard and especial attention paid to the development of frost resistant and late blooming varieties.

Imports of perilla oil, the consumption of which increased rapidly from 1934, were greatly reduced last year due probably to the 4½-cent excise-import tax now in effect. The crop harvested for arrival here in 1938 will be from 75 to 80 per cent of the quantity available in 1937 and 60 per cent of the amount in 1936.

It is stated that perilla and soybean oil can be combined in certain proportions and treated so that the result is practically the equivalent of linseed oil.

The periodic shortage of tung oil has led to a great deal of research to find materials to use in its place. While a large part of this work has been along the line of synthetic replacements, considerable work has been done in attempting to treat available oils so as to render them suitable as substitutes for tung oil.

A method has been developed for the fortifying of linseed by changing the molecular structure to more closely resemble tung oil. Also work has been done on the fortifying of soybean, sardine and fish oils which have shown new properties of hardness and resistance. A method of dehydrating castor oil has been developed which produces an oil superior in drying qualities to linseed and approaching tung oil; but an oil of this character would be rather expensive and there is only a limited amount of castor oil available. Considerable work has been done on the method of cooling fish oils to freeze out the fats which are the non-drying portions and then heat-treating the remaining part.

Large Increase in Warehoused Stocks of Vegetable Oils

MARKED gains in production of crude vegetable oils were made last year. To begin with a large crop of cottonseed was available, consequently the crush was increased accordingly. The rise in paint and varnish manufacture for the greater part of the year acted as a stimulus to linseed crushers and the output of oil, amounting to more than 665,000,000 lb., was the largest since 1929 when production reached a total of 763,576,494 lb. Coconut, corn, and babassu oils also were produced in larger volume last year but a falling off was reported for peanut, soybean, and castor oils.

On the side of consumption, a decided increase likewise was reported but the gain in production was higher than that for consumption and the result was that the carryover into 1938 was unusually large. Of the crude oils, increases in stocks at the close of 1937 as compared with the corresponding period of 1936, were noted for cottonseed, coconut, soybean, olive oil foots, palm-kernel, linseed, China wood, castor, and palm oils.

Consumption of cottonseed oil was especially heavy and the record cotton crop which weakened prices for the oil because of the large supply of seed did not depress values as much as had been anticipated and the very heavy disappearance of cottonseed oil since the beginning of the present oil-year has been one of the outstanding features of the oil market. While the large production of linseed oil was not all consumed, the total used was more than 20 per cent higher than that for 1936, giving consideration only to that used in manufacturing.

China wood oil was imported in record quantities and actual consumption was relatively large. This oil attracted wide interest in the last half of the year because the conflict in China made it difficult to get stocks out of that country. This condition is reflected in the sharp drop in imports entered for consumption in the fourth quarter of the year, the total reported for that quarter being less than 19,000,000 lb. or only a little more than 10 per cent of the importations for the year.

Perilla oil was less prominent both in the import statistics and in consuming channels. Considerable interest was shown in oiticica oil but total imports amounted to less than 3,000,000 lb. but productive capacities in Brazil have been enlarged and this oil may become more important in succeeding years.

Price fluctuations for vegetable oils were frequent throughout the year. The highest levels were reached in the first four months with an almost unbroken downward trend from May to December. Crude cottonseed oil was at its highest point early in the year and reached its low in October when revised estimates for the cotton crop made it appear that probable production of oil would be stepped up to record proportions. However, an active consuming demand for refined oil checked the decline and continued over the remainder of the year. If continued, there will not be so much discrepancy between production and consumption as had been earlier anticipated.

Linseed oil closed the year at prices higher than were current in January. Rising in value during the first quarter of the year, prices thereon held a fairly steady course. Even in the last part of the period when buying interest was of a declining nature, the oil market showed scarcely any traces of weakness. The small domestic supply of flaxseed, a smaller exportable surplus in the Argentine, and a poor market for oil cake had a supporting effect on values for oil.

China wood oil presented an extreme in the price picture and also closed at net higher prices for the year. In the fall months when it was announced that no oil had been exported from China since August, domestic importers were unable to make definite offers on future shipments and for a time quotations skyrocketed but the high prices were largely nominal. Later, quotations were lowered but trading was inactive as stocks held in this country were large and consumers waited to see what developments might arise to return primary markets to a more

Production, Consumption and Stocks of Vegetable Oils

	Production		Consumption		Stocks		
	1937 lb.	1936 lb.	1937 lb.	1936 lb.	Dec. 31, 1937 lb.	Jan. 1, 1936 lb.	Dec. 31, 1936 lb.
Cottonseed, crude	1,628,672,352	1,244,616,982	1,562,674,540	1,246,055,768	200,643,988	132,842,908	143,385,529
Cottonseed, refined	1,450,319,085	1,159,027,720	1,573,248,783	1,169,985,324	447,576,407	402,203,361	427,767,606
Peanut, crude	50,724,281	69,822,493	58,461,980	106,599,150	4,311,751	17,521,947	12,103,948
Peanut, refined	64,494,445	100,057,174	57,130,890	94,893,637	19,163,280	12,031,210	16,084,750
Coconut, crude	266,419,787	258,088,503	453,125,749	590,484,197	165,993,655	127,931,102	59,551,067
Coconut, refined	268,067,067	340,469,323	241,965,550	358,822,533	10,542,683	23,992,468	15,457,567
Corn, crude	126,095,341	121,994,058	156,160,324	157,427,675	8,912,271	12,941,874	11,635,556
Corn, refined	140,107,224	138,124,809	67,765,022	42,973,471	8,889,264	7,682,391	12,875,656
Soybean, crude	194,132,315	225,297,183	158,118,550	202,524,285	44,897,441	20,329,276	20,303,343
Soybean, refined	133,472,517	180,722,187	153,774,524	162,105,421	16,508,560	10,115,051	12,301,564
Olive, edible	.....	3,331,720	3,295,509	3,329,958	2,467,861	2,986,161	4,099,321
Olive, inedible	.....	.....	5,643,383	10,422,695	1,725,290	2,526,910	2,483,364
Sulphur oil	.....	.....	18,357,736	24,374,274	8,550,323	18,094,790	7,023,651
Palm-Kernel, crude	.....	.....	139,234,131	64,808,764	41,033,767	28,403,737	12,530,802
Palm-Kernel, refined	26,202,260	37,471,771	31,005,188	31,748,898	787,595	1,726,857	1,720,917
Rapeseed	.....	.....	14,761,404	52,335,777	5,064,936	12,232,924	14,210,486
Linseed	665,098,850	455,252,646	374,468,861	307,522,178	191,386,262	146,525,727	117,267,639
China wood	.....	.....	120,361,467	108,454,298	48,484,511	19,008,265	28,872,045
Perilla	.....	.....	43,310,497	80,830,309	23,716,308	12,873,195	19,752,392
Castor	68,823,645	84,553,321	35,101,773	31,736,912	18,654,103	7,983,374	12,134,164
Palm	.....	28,158,923	363,281,348	283,554,508	154,280,509	69,527,681	92,030,197
Sesame	.....	65,537,230	37,667,407	55,653,729	5,484,841	11,321,856	11,572,852
Babassu	35,678,179	27,739,787	41,062,096	34,674,749	3,186,047	.....	1,912,625
Hempseed	.....	12,656,415	1,387,913	11,510,960	.....	.....	2,013,197
All other	31,143,225	19,263,015	24,380,712	30,722,061	17,310,100	11,833,362	3,010,391

normal position. The year closed however with every indication that shipments from abroad would be irregular and uncertain for some time.

Relatively high prices for tallow, following a period of low production, were favorable both for consumption of refined vegetable oils in the edible trade and for crude oils in the soap. Excise taxes on imported tallow aided in this movement by holding arrivals of foreign-made tallow to very low figures.

Entering the new year, the oil trade was faced with an avowed intent on the part of crushers to seek a downward adjustment in the excise-import taxes on certain oil seeds so that it might be profitable to extend domestic production of vegetable oils and conversely cut down on the amounts imported. The outcome of this issue may have a marked bearing on 1938 production of oils in this country.

Also in the offing is some uncertainty regarding the method of building up a tariff on oils from the Philippines. This will have no effect this year, in fact not until 1941 if present plans are carried into execution but it is important in forecasting a change in the coconut oil market in the not distant future.

Depreciation Rates for Chemical Process Equipment—*Cont'd*

(*Continued from page 80*)

	Probable Useful Life (*Years*)	Depreciation Rate (*Per Cent*)
Pulp and Paper and Paper Board		
Absorbing system, milk of lime	10	10
Barkers: Drum	10	10
Hand	15	6⅔
Beaters	20	5
Bins, storage, chip	30	3⅓
Bleachers	15	6⅔
Burners, sulphur, acid plant	12	8⅓
Calenders	22	4½
Chippers	20	5
Conveyors: Inside	15	6⅔
Outside	12	8⅓
Cookers	20	5
Coolers	10	10
Cutters	20	5
Cylinder machines, for paper and paper board	20	5
Deckers	20	5
Diffusers	25	4
Digester linings	7	14
Digesters:		
Indirect	22	4½
Rotary	20	5
Vertical, stationary	25	4
Drainers	30	3⅓
Evaporators:		
Disk	17	6
Multiple effect	25	4
Fourdrinier machines	20	5
Furnaces, rotary	17	6
Grinders	20	5
Jordans	18	5½
Knotters	15	6⅔
Kollergangs	20	5
Linings (wool) for blow pits	8	12½
Melters, sulphur	8	12½
Pans:		
Causticizing	15	6⅔
Wash	25	4
Pits, blow:		
Concrete	30	3⅓
Steel tank	20	5
Platers	13	7½
Pumps:		
Acid	5	20
Centrifugal	15	6⅔
Plunger, duplex or triplex	18	5½
Pressure	15	6⅔
Vacuum	15	6⅔
Reels	15	6⅔
Rifflers:		
Concrete	30	3⅓
Wood	18	5½
Save-alls	20	5
Screens:		
Silver	12½	8
Rotary	15	6⅔
Shredders	12	8⅓
Slashers	14	7
Smelters, sulphate process	7	14
Stackers, pulpwood	14	7
Tanks:		
Causticizing	20	5
Leeching	22	4½
Mixing (wood)	12	8⅓
Mixing (wood) for clay	20	5
Storage, acid	12	8⅓
Storage or washing (concrete)	30	3⅓
Storage or washing (wood)	15	6⅔
Thickeners	20	5
Towers, absorbing system	15	6⅔
Washers, bleach or paper stock	20	5
Wet machines	18	5½
Rubber Goods		
Autoclaves	10	10
Boards, stock (wood)	4	25
Calenders	18	5½
Conveyors	15	6⅔
Covering machines	13	7½
Crackers, rubber	15	6⅔
Devulcanizers, reclaimed rubber	15	6⅔
Dipping machines	10	10
Disintegrators	15	6⅔
Drums	12	8⅓
Dryers	14	7
Dusting machines, including chalking	15	6⅔
Furnaces	15	6⅔
Grinders, pigment	15	6⅔
Mills, mixing or warming:		
Heavy duty	17	6
Light duty	15	6⅔
Mixers:		
Large	17	6
Small	15	6⅔
Ovens	15	6⅔
Presses, cold	20	5
Pulverizers	15	6⅔
Reeling machines	15	6⅔
Refiners, roll type	14	7
Rolling machines	15	6⅔
Sealing machines	14	7
Separators	14	7
Sheeters	15	6⅔
Sifters	14	7
Strainers	12	8⅓
Varnishing machines	15	6⅔
Vulcanizers	15	6⅔
Washers	15	6⅔
Winding machines	15	6⅔
Wrapping machines	12½	8
Cement, Ceramics, Glass, Gypsum, and Lime and Limestone		
Agitators	15	6⅔
Augers	14	7
Baggers	15	6⅔
Beaters, tub	15	6⅔
Blowers	15	6⅔
Blungers	12	8⅓
Bottle machines	10	10
Brick-making machines	12½	8
Burners	15	6⅔
Calciners, continuous	15	6⅔
Cars:		
Batch	12½	8
Dryer or kiln	15	6⅔
Mine—		
Steel	10	10
Wood	5	20
Transfer	10	10
Casting and rolling tables	12½	8
Charging machines	10	10
Controllers, temperature, automatic	10	10
Conveyors	15	6⅔
Coolers	13	7½
Crushers	15	6⅔
Cut-off machines	14	7
Cutting machines	14	7
Cutting machines, rock lath	20	5
Disintegrators	8	12½
Drag lines:		
Heavy	20	5
Light	10	10
Medium	15	6⅔
Dryers	11	9
Dryers, rotary	15	6⅔
Duster machines, bag	15	6⅔
Dust collectors	20	5
Elevators:		
Bucket	15	6⅔
Screw	18	5½
Feeders	12½	8
Filter presses	15	6⅔
Furnaces	15	6⅔
Furnaces, pot	12½	8
Grinders	15	6⅔
Hydrators	15	6⅔
Jigs	10	10
Kettles	15	6⅔
Kilns	15	6⅔
Lehrs	15	6⅔
Loading machines	10	10
Mills	15	6⅔
Mixers	14	7
Molds	5	20
Molds, hydraulic	12	8⅓
Mud machines	12½	8
Ovens, flattening	12½	8
Packers	10	10
Pallets and trays	8	12½
Pans, dry	15	6⅔
Plungers	10	10
Polishers	12½	8
Presses	20	5
Pulverizers	15	6⅔
Pumps	15	6⅔
Pumps, clay	10	10
Reels	20	5
Riddles, gyratory	10	10
Scales:		
Platform	20	5
Portable	15	6⅔
Screens	10	10
Separators:		
Air	10	10
Magnetic	14	7
Shovels, electric or steam	15	6⅔
Sieves	8	12½
Sifters, revolving	10	10
Tables, drawing, grinding, or polishing	12½	8
Tanks	20	5
Oil and Gas Refining		
Agitators	16	6¼
Carbon, black plants	12½	8
Condensers	15	6⅔
Exchangers, heat	15	6⅔
Filtering plants	20	5
Gasoline plants, natural gas	12½	8
Pipes, interunit lines, small diameter	15	6⅔
Pumps	15	6⅔
Stills:		
Cracking	8	12½
Fire	15	6⅔
Steam	15	6⅔
Tube or pipe	12	8⅓
Vacuum	15	6⅔
Tanks:		
Compounding	20	5
Storage	20	5
Treating	16	6¼
Towers, scrubbing	15	6⅔
Traps, gas and water	12	8⅓
Wax plants	20	5

Wood Rosin and Turpentine Gain In Domestic Trade

THE market for naval stores was featured by a continued rise in production of both wood rosin and wood turpentine. Despite a falling off in output in December the total of 739,021 bbl. of rosin exceded that of 661,047 bbl. in 1936 by about 11.8 per cent and the turpentine comparison was 116,036 bbl. 1937 and 104,396 bbl. for 1936.

Early estimates for gum spirits of turpentine and rosin had indicated a substantial increase in production for the present crop year. As the year advanced, however, these estimates were revised downward and at the close of the year, receipts from interior points were running low and it was thought only a small part of the crop remained to be marketed. When the figures for the crop year become available it is probable that very little change in production was made from that of the preceding year. The recent change by which the Department of Agriculture issues a semi-annual report makes it possible to make more accurate estimates regarding the years supply but the first semi-annual report—that for April-Sept. 1936—was not complete as reports were received from only 67 per cent of the total industrial consumption of turpentine and but 82 per cent of industrial rosin consumption. The 1937 report calls attention to the seasonal nature of gum naval stores production and points out that normally about 72 per cent of the total annual gum crop is produced from April through September. The report also points out that, in the table in which consumption of rosin and turpentine are given for the respective industries, the sharp rise in the allocation for "Chemicals and pharmaceuticals" is due chiefly to the inclusion for the first time of the turpentine and rosin consumed at wood naval stores producers' plants in the production of derived products which were marketed as chemicals or under some name other than naval stores.

The year was unsatisfactory because the price trend was downward with spirits of turpentine especially holding at low levels. Gum spirits found a better call from domestic consumers but export buying was below that of the preceding year and far below the standards of a few years ago. As a result sales pressure was in evidence for a good part of the time and while partial recoveries may be expected at intervals, the basic factor at keeping supply and demand in close harmony must be attained before a stabilized market can be expected.

Export statistics for the first eleven months of the year showed a gain over the corresponding period of 1936 for both wood rosin and wood turpentine. The reverse was true, however, for gum rosin and gum turpentine, gum rosin particularly making a poor showing with 804,248 bbl. given as the total for the 1936 period and 687,579 bbl. for 1937.

Production outside the United States continues to increase. During November production of naval stores in Portugal continued in advance of the 1936 output, while exports showed a further slight decline. For the first 9 months of 1937 official statistics report the total output at 6,324 metric tons of turpentine and 24,805 tons of rosin. These figures compare with 3,852 tons of turpentine and 6,886 metric tons of rosin produced for the first 9 months of 1936. No official data are obtainable regarding stocks of turpentine and rosin on hand at the end of November, but based upon production and export figures and assuming that stocks of the 1936 production were exhausted before the shipment of the 1937 output, it is calculated that stocks on hand at the end of September 1937 totaled approximately 2,700 metric tons of turpentine and 11,900 tons of rosin. Total exports for the first 10 months of 1937 were 6,577 metric tons of turpentine in contrast

Detailed Production Data for Turpentine and Rosin

	Turpentine			Rosin		
	1937–38 April-Sept. bbl.-50 gal.	1936–37 April-Sept. bbl.-50 gal.	1936–37 Fiscal Year bbl.-50 gal.	1937–38 April-Sept. bbl.-500 lb.	1936–37 April-Sept. bbl.-500 lb.	1936–37 Fiscal Year bbl.-500 lb.
Gum	361,986	345,700	482,787	1,114,069	1,076,367	1,565,240
Reclaimed, gum	.....	.....	.....	8,543	19,178	42,694
Steam distilled, wood	70,086	53,736	122,388	421,328	332,392	724,028
Sulphate, wood	9,386	5,635	22,635	.....	.....	.....
Destructive dist., wood	3,421	3,455	6,710	.....	.....	.....
Total	444,879	408,526	634,520	1,543,940	1,427,937	2,331,962

Supply, Distribution and Carryover of Turpentine and Rosin

	Turpentine			Rosin		
	1937–38 Apr.–Sept. 6 mos.	1936–37 Apr.–Sept. 6 mos.	1936–37 Apr.–Mch. 12 mos.	1937–38 Apr.–Sept. 6 mos.	1936–37 Apr.–Sept. 6 mos.	1936–37 Apr.–Mch. 12 mos.
	bbl.-50 gal.			bbl.-500 lb.		
Supply and Distribution						
Carryover April 1	223,364	230,136	230,136	663,251	765,807	765,807
Production	444,879	408,526	634,520	1,543,940	1,427,937	2,331,962
Imports	5,310	9,648	15,929	332	2,041	2,418
Available supply	673,553	648,310	880,585	2,207,523	2,195,785	3,100,187
Less carryover Sept. 30	280,199	(1)	223,364	912,922	(1)	663,251
Apparent total consumption	393,354	(1)	657,221	1,294,601	(1)	2,436,936
Less exports	156,639	160,526	271,353	610,752	624,549	1,099,438
Apparent U. S. consumption	236,715	(1)	385,868	683,849	(1)	1,337,498
Production and Imports						
Gum	361,986	345,700	482,787	1,122,612	1,095,545	1,607,934
Wood	82,893	62,826	151,733	421,328	332,392	724,028
Imports	5,310	9,648	15,929	333	2,041	2,418
Total	450,189	418,174	650,449	1,544,272	1,429,978	2,334,380
Carryover (Stocks)						
Carryover April 1	223,364	230,136	230,136	663,251	765,807	765,807
Carryover September 30	280,199	(1)	22,3364	912,922	(1)	663,251
Increase	56,835	.....	.....	249,671	.....	.....
Decrease	.....	.....	6,772	.....	.....	102,556

[1] Omitted due to the fact that reports of consumption and consumers' stocks were received from only consumers reporting 67% of turpentine and 82% of rosin reported consumed in 1935–36.

with 6,897 for the 1936 period and 24,218 metric tons of rosin, as against 29,287 for the same months of 1936.

France expanded its output and despite some increase in exports in the latter part of the year, stocks were added to and the statistical situation became more complicated. Exports from France for the year showed gains for turpentine but declines for rosin.

From Greece comes the report that the harvesting of the gum crop and its removal to the stills were completed under favorable weather conditions the end of November. Trade estimates of the crop yield for the season's end were the same as previous ones, namely between 26,500 to 27,000 metric tons of crude gum. Demand for rosin was fairly active in recent months and prospects of disposing of the entire output the end of the year were good. Turpentine demand was weak and it is almost certain that this year's operations will result in a comparatively heavy carry-over into next year of an estimated quantity of 1,000 tons. Stocks on hand the end of November totaled about 2,000 metric tons of turpentine and 2,800 tons of rosin.

Exports of turpentine and rosin were improved with resumption of trade with Germany and better demand from Italy. Total exports of turpentine from Greece for the months of May to November inclusive were 2,936 metric tons. Italy was the largest buyer, taking approximately 57 per cent of the total, followed by Rumania with 21 per cent and Germany 9 per cent. Rosin exports for the same period amounted to 13,527 metric tons. Italy was likewise the leading purchaser represented in the trade by 38 per cent; Rumania was next with 26 per cent and Germany 12 per cent.

Localization of Chemical Process Industries

To present a factual picture of the relative importance of the principal industrial areas of the United States in their relation to the manufacture of "Chemicals and Allied Products", the editors of *Chem. & Met.* have tabulated and charted most recent Census data in the form of an editorial supplement to accompany this Annual Review and Statistical number. This makes available for the first time an accurate, numerical ranking of the various industrial areas. In addition, the editorial supplement includes a series of maps showing both localization and concentration of the chemical process industries in the United States.

Production of Inorganic Pigments in 1936

The U. S. Tariff Commission has issued statistics of domestic production and sales of chrome yellow, chrome greens, and iron blues in 1936. Chrome yellow is lead chromate, chrome green is a mixture of chrome yellow and Prussian blue, and iron blues, which include Prussian blue, are iron ferrocyanide or iron ferricyanide compounds. These pigments are used generally to impart color to such products as paints, enamels, lithographic and writing inks, and wall paper. Iron blues are employed extensively in soluble laundry blues.

All of these pigments are produced and sold in the pure (C.P.) form and in forms reduced with inert extenders which dilute the colors to a desired shade. As shown in the table, chrome greens are made and sold in the reduced form to a much greater extent than is the case with chrome yellows and iron blues.

The figures given represent returns from 39 producers, presumably about 85 per cent of the total number, and probably account for more than 85 per cent of the total output.

Domestic Production and Sales of Certain Inorganic Pigments, 1936

Product	Number of producers reporting	Production	Sales	
		Quantity lb.	Quantity lb.	Value Dollars
Chrome yellows, C.P.	32	36,255,605	33,798,998	3,850,451
Chrome yellows, reduced	20	1,543,729	838,703	71,234
Chrome greens, C.P.	21	9,355,743	8,670,636	2,307,483
Chrome greens, reduced down to and including 25 percent	17	5,591,932	5,340,607	447,526
Chrome greens, all other reduced	13	1,514,137	1,612,586	119,176
Iron blues, C.P.	25	6,209,781	5,688,580	2,091,060
Iron blues, reduced	12	204,063	150,339	28,076

Reported Consumption of Turpentine and Rosin in the United States

(Combined gum and wood products)
April–Sept. 1937 with April–Sept. 1936.

	Turpentine bbl.–50 gal.				Rosin bbl.–500 lb.			
	Reported Totals Apr.–Sept.		Comparable Reported Totals Apr.–Sept.		Reported Totals Apr.–Sept.		Comparable Reported Totals Apr.–Sept.	
	1937	1936	1937	1936	1937	1936	1937	1936
Abattoirs	.....	.....	.....	.....	1,174	449	519	447
Adhesives and plastics	231	132	58	132	9,318	7,652	5,488	5,688
Asphaltic products	2	.....	2	.....	862	697	862	697
Automobiles and wagons	318	153	200	153	361	622	200	622
Chemicals and pharmaceuticals	18,646	4,540	13,345	4,540	68,416	35,325	39,959	34,289
Ester gum and synthetic resins	.....	.....	.....	.....	58,258	40,321	47,476	40,306
Foundries and foundry supplies	500	88	67	67	11,031	5,650	6,795	5,650
Furniture	299	150	140	150	51	105	.....	.....
Insecticides and disinfectants	275	230	254	181	2,626	2,212	2,294	2,212
Lineoleum and floor covering	43	35	43	35	17,672	12,137	15,348	12,137
Matches	.....	.....	.....	.....	1,094	1,238	805	1,238
Oils and greases	110	24	14	24	12,570	12,907	10,208	12,907
Paint, varnish and lacquer	34,837	22,532	20,742	20,851	83,835	30,428	31,272	28,845
Paper and paper size	7	.....	.....	.....	202,702	180,060	178,699	180,060
Printing ink	94	120	92	120	5,196	7,030	5,124	7,030
Railroads and shipyards	3,456	1,765	2,413	1,745	499	140	79	75
Rubber	94	90	94	90	1,587	1,133	1,520	1,133
Shoe polish and shoe materials	6,439	4,177	6,024	4,177	3,728	4,609	3,208	4,609
Soap	3	.....	.....	.....	115,864	150,453	112,568	150,453
Other industries	924	392	316	392	3,088	1,461	1,757	1,336
Total	66,278	34,428	43,804	32,657	599,932	494,629	464,181	489,734

(*Continued from page 93*)

one non-cellulose base plastic was spun successfully. In Europe, production of casein fiber is growing in importance, and Italian interests have been attempting to arouse interest in the process in the United States. In fact, it is reported that one small pilot plant operating on casein is actually in production here.

No definite information is available on production of viscose and acetate transparent sheeting during the year. It is reasonable to estimate, however, that about a 12 per cent increased was accomplished, with a total of perhaps 80,000,000 lb. of which about 10,000,000 lb. was acetate.

German Potash Companies Combine More Closely

THREE leading potash companies, which together control 25 per cent of Germany's entire output, recently reorganized with the view to simplifying the corporate structure, effecting economies, and making provision for future expansion, according to a report from the American Consulate General, Frankfort-on-Main.

The new organization, known as the "Salzdetfurth A.G." will include the Salzdetfurth, Aschersleben, and Westeregeln companies. Historically these three companies have been closely affiliated. At the time of the consolidation, the leading Salzdetfurth company held about one-half of the common stock capital of each of the Aschersleben and Westeregeln companies, while each of these two companies in turn held one-fourth of the 28,000,000 marks of common stock capital of Salzdetfurth.

The consolidation of the three companies into one unified concern is expected to eliminate costly adminstrative detail work and enable a much more effective managerial control, considered of vital importance at the present time when the German potash industry is undergoing far-reaching changes and is confronted with serious problems of expansion, diversification, and cost-reduction, in keeping with the increased competition in the international potash trade and Germany's ambitious "Four Year Plan" of maximum possible national production.

The consolidated "Salzdetfurth A.G." will be in the nature of a holding company. This concern will have as principal operating subsidiary a newly formed company, the "Vereinigte Kialwerke Salzdetfurth A.G.", capitalized at 30,000,000 marks, in which will be concentrated all of the potash properties of the hitherto existing three separate companies. This subsidiary will take approximately 20,000,000 marks of the foreign potash loan owing by the three affiliated companies, while the additional 17,000,000 marks owed by them will be taken over by the holding company. Another operating subsidiary, known as the "Electrochemische Fabriken A.G.", will acquire and operate the purely chemical plants of the merged companies, including plants producing chlorine, caustic soda, caustic potash, and the woodpreservative "Xylamon," as well as a brown-coal mine, a power plant, and a rock salt mine.

The new consolidated company will have as a major near-term objective the carrying out of extensive projects of plant enlargement and modernization and development of entirely new production spheres, considerable capital for the financing of which is created by the plan of reorganization.

Sales of Lead and Zinc Pigments

	1936 Short Tons	1937 Short Tons
Basic lead sulphate lead:		
White	[1] 7,531	[1] 8,200
Blue	[1] 891	[1] 1,000
Red lead	34,896	31,200
Orange mineral	248	280
Litharge	86,246	85,200
White lead:		
Dry	34,775	33,100
In oil [2]	83,632	69,200
Zinc oxide	126,800	113,500
Leaded zinc oxide	40,512	40,200
Lithopone	158,319	154,600
Zinc sulphate	8,687	10,100

[1] Exclusive of basic lead sulphate used for the manufacture of leaded zinc oxide which is included in tonnages shown for that pigment.
[2] Weight of white lead only.

Domestic Production of Casein By States

Producing State	1934 1000 lb.	1935 1000 lb.	1936 1000 lb.
Arizona	.....	168	135
California	11,012	10,537	11,156
Colorado	.....	.....	63
Connecticut	17	.....	.....
Idaho	1,500	1,422	1,382
Illinois	2,446	1,565	2,945
Indiana	8	.....	59
Iowa	42	355	22
Kansas	.....	.....	77
Maine	.....	.....	135
Massachusetts	.....	27	.....
Michigan	208	338	417
Minnesota	1,008	1,943	2,502
Missouri	.....	100	1,060
Montana	114	41	41
New York	3,992	4,413	6,263
Ohio	.....	9	460
Oklahoma	.....	.....	2
Oregon	134	107	94
Pennsylvania	287	246	195
Utah	38	.....	.....
Vermont	4,159	3,542	2,279
Washington	489	721	1,153
Wisconsin	11,876	11,999	15,653
Wyoming	.....	.....	47

Chemical Stocks Rate High

Growth in the chemical industry is well exemplified by the importance which the stocks of chemical companies have attained in comparison with other industrial groupings. Taking values as of Jan. 3, 1938, the chemical group outranked all other classifications from the stand point of total market value as established by the New York Stock Exchange.

The following table shows the market value of stocks, classified by industries, on Jan. 3.

	Market Value	Average Price
Autos & Accessories	$2,309,660,158	$19.92
Financial	850,783,472	16.31
Chemicals	4,740,707,834	54.48
Building	484,246,926	22.75
Electrical Equip. Mfg.	1,639,451,091	42.49
Foods	2,516,293,932	27.83
Rubber & Tires	288,451,442	27.31
Farm Machinery	633,180,950	47.16
Amusements	278,860,987	15.44
Land & Realty	30,533,117	6.11
Mach. & Metals	1,423,800,448	22.58
Mining (excl. iron)	1,617,315,341	24.81
Petroleum	4,612,945,686	24.00
Paper & Pub	287,924,588	16.22
Retail Merch	1,802,359,291	24.49
Railways & Equip.	3,218,884,064	27.35
Steel, Iron & Coke	1,995,762,736	40.22
Textiles	199,095,038	15.23
Gas & Electric (op)	1,677,159,705	23.63
Gas & Electric (hold.)	1,169,280,890	12.04
Communications (Cable, Tel. & Radio)	3,162,283,606	84.26
Misc. Utilities	129,276,808	11.86
Aviation	286,192,996	12.46
Bus. & Office Equip.	303,008,421	26.75
Shipping Services	6,172,634	2.95
Ship Op. & Build	27,266,461	9.00
Misc. Bus	78,289,948	13.22
Leather & Boots	156,855,474	22.95
Tobacco	1,385,727,777	52.08
Garments	21,643,527	12.89
U. S. Cos. op. abroad	564,654,556	17.68
Foreign Cos. (incl. Cuba & Canada)	973,070,721	25.21

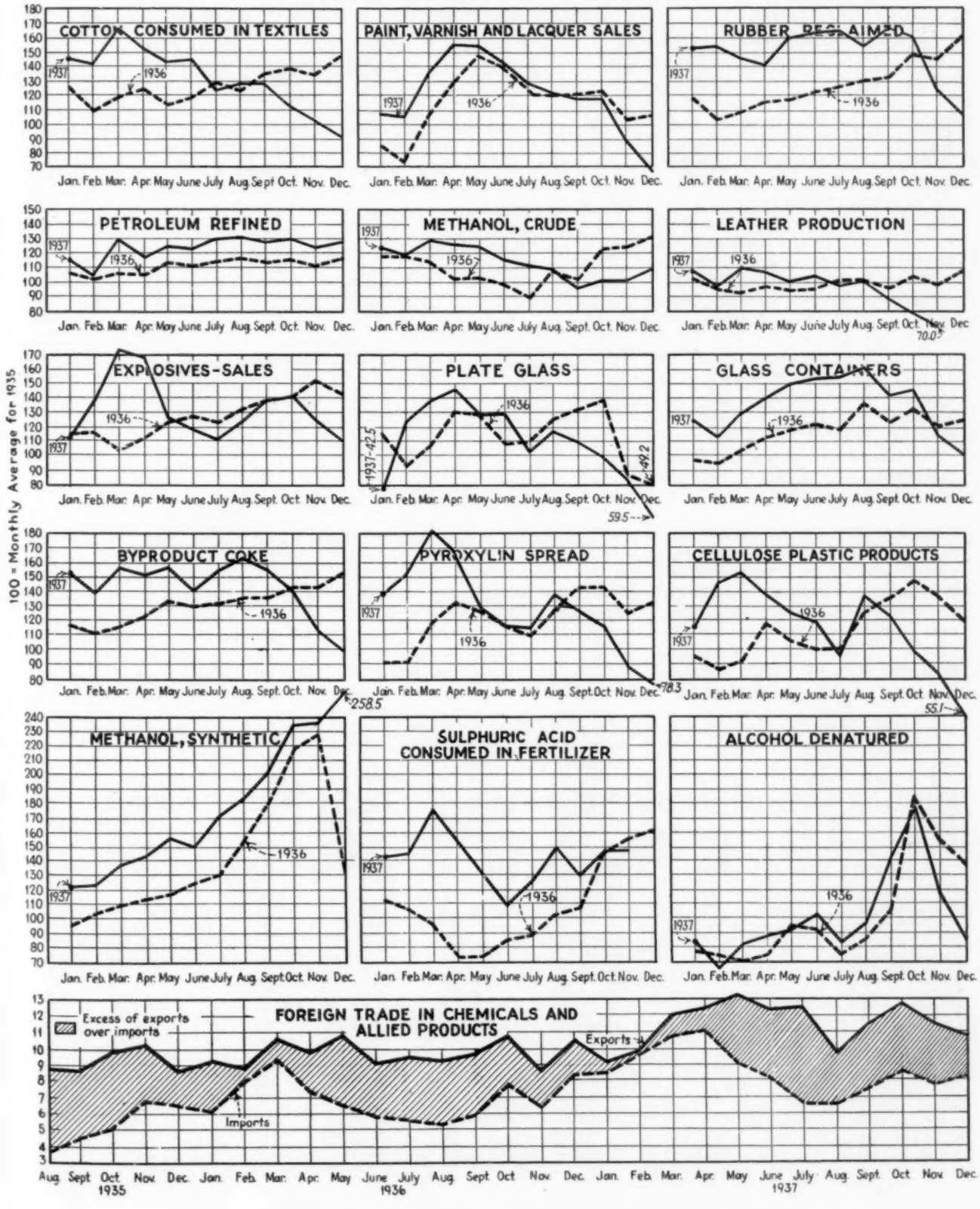
Production of Methanol

1937	Production (Gallons) Crude	Synthetic
January	525,070	1,835,815
February	500,685	1,849,302
March	546,662	2,071,747
April	531,727	2,138,895
May	522,961	2,353,497
June	485,943	2,263,507
July	465,205	2,564,783
August	462,584	2,735,963
September	404,112	3,018,333
October	423,792	3,532,091
November	423,315	3,562,372
December	461,539	3,887,741
Total	5,753,595	31,814,046

Alcohol Produced at Industrial Plants and Withdrawals for Denaturing

Fiscal Year	Alcohol Produced Proof Gal.	Ethyl Alcohol Withdrawn for Denaturation, Proof Gal.	Denatured Alcohol Produced— Completely, Wine Gal.	Special Wine Gal.	Total, Wine Gal.
1922	79,906,101.50	59,549,919.6	16,193,523.60	17,152,224.31	33,345,747.91
1923	122,402,849.81	105,819,404.9	27,128,229.54	30,436,913.14	57,565,142.68
1924	135,897,725.83	121,576,196.1	34,602,003.72	33,085,292.04	67,687,295.76
1925	166,165,517.81	148,970,220.9	46,983,969.88	34,824,303.28	81,808,273.16
1926	202,271,670.32	191,670,107.2	65,881,442.43	39,494,443.80	105,375,886.23
1927	184,323,016.97	170,633,436.7	56,093,748.16	39,354,928.48	95,448,676.64
1928	169,149,904.83	159,689,378.2	46,966,601.28	45,451,424.28	92,418,025.56
1929	200,832,051.08	182,778,966.1	52,405,451.92	54,555,006.15	106,960,458.07
1930	191,859,342.42	181,601,420.3	58,141,740.88	47,645,796.84	105,787,537.72
1931	166,014,346.15	149,303,438.5	49,136,200.64	37,172,740.71	86,308,941.35
1932	146,950,812.76	132,578,234.7	34,298,235.54	44,031,281.80	78,329,517.34
1933	115,609,754.29	103,753,240.7	26,254,230.80	35,076,115.90	61,600,346.70
1934	165,103,582.00	137,416,765.0	27,174,311.00	55,067,092.00	82,241,403.00
1935	180,645,920.00	163,009,786.0	38,746,679.00	58,284,395.00	97,031,074.00
1936	196,126,236.00	172,478,748.0	36,522,358.00	64,955,485.00	101,477,843.00
1937	223,181,228.00	179,324,373.0	22,118,378.00	80,084,281.00	102,202,659.00

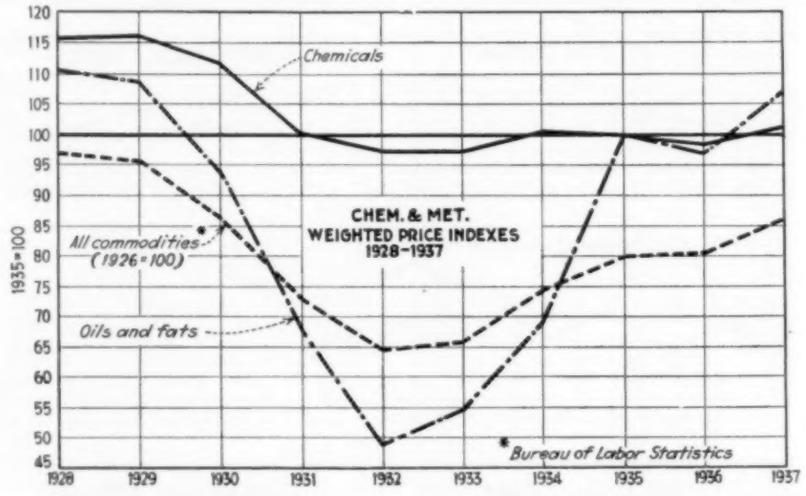
TRENDS OF PRODUCTION AND CONSUMPTION



Price Indexes Revised According to Latest Census Data

IN January 1922, *Chem. & Met.* presented a newly devised index designed to offer a medium for measuring changes in sales prices for chemicals. To make up this index 25 chemicals, selected because of their volume importance and diversified so as to be representative of the various branches of the chemical industry, were converted to their respective sales values and each assigned its proportionate part of the combined total. Production data for 1919 supplied by the Bureau of the Census, amplified by the addition of importations in that year, gave the total available for sale which was turned into dollar values by taking the average sales price of each of the selected commodities as a base price.

Because of the changes from year to year which bring about variations in the weighted importance of different chemicals it is desirable to revise the index as later production data become available. At the beginning of 1925, census data for 1923 were used for such a revision and in 1930, the weighting was based on the quantities and prices of 1927. Because the 1929, 1931 and 1933 census years represented extremes in both production and price fluctuations, the 1927 base compilation was maintained through last year. With a return to more normal conditions, the index has been again revised on the basis of the 1935 census returns which more accurately portray the relative positions of the components of the index. Following the method employed in the preceding revision, the list of chemicals has been further extended, the new additions being butyl alcohol and carbon tetrachloride in order to give more commensurate recognition to the rapid growth in the output of synthetic organic chemicals,



Basic Data for *Chem. & Met.* Weighted Index of Chemical Prices

	Production 1935	Imports 1935	Total Supply	Basic Price	Value	Per Cent of Total
Acid, Acetic, Basis 28%, lb	352,490,500	35,096,288	387,586,788	$0.0243	$9,418,359	2.01
Acid, Hydrochloric, Basis 18°, lb	623,853,860	34,802	623,888,662	.01	6,238,887	1.33
Acid, Nitric, Basis 36°, lb	468,818,400	392,699	469,211,099	.05	23,460,555	5.00
Acid, Sulphuric, Basis 60°, ton	5,173,431	1,042	5,174,473	11.00	56,919,293	12.12
Alcohol Butyl, lb	58,145,494	.....	58,145,494	.125	7,268,187	1.55
Alcohol Denatured, gal	97,565,648	92	97,565,648	.36	35,123,632	7.48
Aluminum Sulphate, lb	728,166,000	1,938,715	730,104,715	.0135	9,856,414	2.12
Ammonia Anhydrous, lb	138,245,032	.....	138,245,032	.155	21,427,980	4.56
Ammonium Sulphate, lb	985,310,831	158,124,000	1,143,434,831	.012	13,721,218	2.92
Aniline Oil, lb	32,572,809	.....	32,572,809	.145	4,723,057	1.01
Arsenic, White, lb	28,474,000	30,149,938	58,623,938	.035	2,051,838	0.44
Benzol, gal	24,106,000	277,229	24,383,229	.155	3,779,400	0.81
Borax, lb	212,274,000	748	212,274,748	.021	4,457,770	0.95
Calcium Carbide, lb	294,184,000	481,500	294,665,500	.05	14,733,275	3.14
Carbon Bisulphide, lb	117,757,762	.....	117,757,762	.055	6,476,677	1.38
Carbon Tetrachloride, lb	55,785,546	.....	55,785,546	.055	2,928,741	0.62
Chlorine, Liquid, lb	638,606,000	.....	638,606,000	.02025	12,931,772	2.75
Copper Sulphate, lb	54,395,039	46,092	54,441,131	.0385	2,095,984	0.45
Ethyl Acetate, lb	57,865,429	.....	57,865,429	.085	4,918,560	1.05
Formaldehyde, lb	64,000,000	375	64,000,375	.06	3,840,023	0.82
Lithopone, lb	322,639,266	9,206,000	331,845,266	.045	14,933,037	3.18
Phenol, lb	43,418,579	2,605	43,421,184	.143	6,209,229	1.32
Methanol, Synthetic, gal	18,046,929	.....	18,046,929	.355	6,406,660	1.36
Salt Cake, ton	169,842	98,553	268,395	13.00	3,489,135	0.74
Soda Ash, 58% Light, lb	5,017,718,000	39,140	5,017,757,140	.0123	61,717,931	13.15
Soda Caustic, Solid 76%, lb	1,517,082,000	293,115	1,517,375,115	.026	39,451,753	8.40
Sodium Bichromate, lb	74,220,000	.....	74,220,000	.059	4,378,980	0.93
Sodium Phosphate, lb	264,412,000	2,779	264,414,779	.02	5,288,296	1.13
Sodium Silicate, lb	1,297,654,000	218,119	1,297,772,119	.008	10,382,177	2.21
Sulphur, ton	1,634,990	1,763	1,636,753	18.00	29,461,554	6.28
Turpentine, Gum, gal	24,880,000	625,148	25,505,148	.505	12,880,100	2.74
White Lead, Dry, lb	210,260,000	12,000	210,272,000	.065	13,667,680	2.91
Zinc Oxide, lb	257,203,951	3,982,093	261,186,044	.0566	14,783,130	3.14
					$469,421,194	100.00

CHEM. & MET.
Weighted Index of CHEMICAL PRICES

Base = 100 for 1935

This month	**101.22**
Last month	101.40
February, 1937	101.02
February, 1936	99.53

Sulphate of ammonia was firmer but copper sulphate, tin salts, and spirits of turpentine were lower and the index number dropped slightly for the month.

CHEM. & MET.
Weighted Index of Prices for OILS AND FATS

Base = 100 for 1935

This month	**83.90**
Last month	83.14
February, 1937	123.17
February, 1936	99.81

Crude cottonseed, corn, and peanut oils were stronger but coconut oil sold off. Tallow also closed at a net decline. The index number settled somewhat higher than a month ago.

and copper sulphate to give fuller consideration to the status of metal salts. Synthetic methanol has been substituted for the natural product since the latter has assumed by far the greater market importance.

The same vegetable oils and fats used in the previous index have been retained in the current index. They cover a fairly comprehensive cross-section of the entire industry including those for which domestic production is large and those which are extensively imported.

The new set-up indicates that oils produced domestically have more than held their own. Crude cottonseed, corn, soybean, and peanut oils have improved their relative standings. Tallow likewise has become a more decisive price factor. Crushing operations at linseed plants were not so high in 1935 as they had been in 1927 and as a result this dropped somewhat in the price structure. Glycerine also is rated below its 1927 rating.

In both indexes data for domestic production has been taken from the U. S. Bureau of the Census or from the Tariff Commission report on dyes and other synthetic organic chemicals. In the case of formaldehyde production data were not available and the figure used is a *Chem. & Met.* estimate. In the oil index the total for domestic production of China wood oil is a trade estimate and the figure for menhaden oil is on the authority of the U. S. Bureau of Fisheries. Import data come from the Department of Commerce.

Basic Data for *Chem. & Met.* Weighted Index of Oils and Fats Prices

Commodity	Production Lb.	Imports Lb.	Total Supply Lb.	Base Price 1935 Per Lb.	Total Value	Per Cent of Total
Cottonseed oil	1,184,038,860	166,687,367	1,350,726,227	$0.0928	$125,347,396	36.24
Linseed oil	502,043,424	2,232,451	504,275,875	.093	46,897,656	13.56
Coconut oil	252,841,492	353,396,002	606,237,494	.0468	28,371,915	8.20
Corn oil	99,787,789	25,746,090	125,533,879	.0957	12,013,592	3.47
China wood	400,000	120,058,817	120,458,817	.159	19,152,952	5.54
Castor oil	46,627,313	258,343	46,885,656	.0975	4,581,351	1.32
Soy Bean oil	105,056,204	14,248,574	119,304,778	.0876	10,450,999	3.02
Peanut oil	44,573,069	80,723,225	125,296,294	.094	11,777,852	3.40
Palm oil	.....	297,579,208	297,579,208	.048	14,283,802	4.13
Menhaden oil [1]	4,066,159	.....	4,066,159	.30	1,219,848	0.35
Tallow, Inedible	392,150,076	245,850,922	638,000,998	.066	42,108,066	12.18
Red oil	35,885,095	1,486,618	37,371,713	.088	3,288,711	0.95
Oleo oil	74,557,651	1,625,925	76,183,576	.128	9,751,498	2.82
Olive Foots (sulphur oil)	.....	33,797,218	33,797,218	.084	2,838,966	0.82
Glycerine, crude	141,184,825	8,220,934	149,405,759	.0925	13,819,033	4.00
					$345,903,637	100.00

[1] Quantity and base price on gallon basis.

***Chem. & Met.* Weighted Index Numbers for Chemical Prices**

	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
January	117.87	115.60	115.80	106.64	98.19	96.79	99.94	100.33	99.57	98.94
February	116.66	115.70	114.87	102.68	98.12	96.75	100.47	99.88	99.53	101.02
March	115.30	116.15	114.92	103.09	98.30	96.93	100.54	99.88	99.31	102.01
April	115.67	116.02	113.55	100.97	97.21	96.58	100.28	100.13	98.86	101.28
May	115.40	116.14	112.95	100.93	97.65	96.88	100.56	100.13	98.64	101.76
June	114.91	115.95	112.22	100.69	97.04	97.19	100.35	100.07	98.58	101.80
July	114.28	115.94	110.73	99.87	96.80	97.84	99.98	100.03	98.70	102.04
August	114.56	115.79	109.59	99.67	97.04	97.82	100.01	99.75	98.86	102.27
September	115.28	115.48	109.78	98.35	97.07	97.65	99.90	99.83	97.73	102.46
October	115.22	115.84	109.53	98.31	96.86	97.62	100.11	99.85	98.31	102.25
November	115.59	116.08	109.20	97.80	96.79	98.13	100.16	100.01	98.17	101.91
December	115.68	116.45	107.63	97.52	97.70	98.32	100.36	100.01	98.33	101.50
Average	115.54	115.93	111.74	100.54	97.40	97.38	100.22	100.00	98.72	101.60

***Chem. & Met.* Weighted Index Numbers for Oils and Fats**

	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
January	114.12	113.28	103.15	78.02	52.58	44.84	54.99	94.26	100.73	122.23
February	108.12	115.06	103.37	73.95	52.33	43.43	56.92	98.90	99.81	123.17
March	108.61	114.60	100.17	76.11	51.70	44.84	59.44	108.21	93.16	122.74
April	111.55	111.10	102.19	78.26	46.65	44.53	60.37	103.13	95.06	125.85
May	113.07	105.00	99.26	74.29	45.77	55.45	60.86	101.98	89.35	113.76
June	108.79	102.23	96.38	69.72	42.71	63.10	60.76	99.23	87.13	109.34
July	108.09	101.67	94.18	73.24	46.72	67.52	63.92	95.65	86.00	102.53
August	107.66	106.18	93.81	67.85	48.93	67.79	67.30	95.91	99.58	98.63
September	108.16	109.19	85.88	56.74	54.71	58.94	73.44	97.88	100.82	94.69
October	111.96	114.70	81.77	53.16	50.55	57.02	79.23	103.85	102.56	94.19
November	110.04	108.85	81.00	56.96	49.99	56.74	84.37	100.34	101.29	91.40
December	113.11	107.34	80.31	54.90	45.18	55.84	115.08	101.39	108.73	84.96
Average	110.27	109.10	93.45	67.75	48.99	55.00	69.73	100.00	97.02	106.98

Chemical Engineering NEWS

COMPRESSED GAS MANUFACTURERS HOLD ANNIVERSARY MEETING

Celebrating its 25th anniversary in appropriate style, the Compressed Gas Manufacturers' Association met in New York, Jan. 17 and 18, for its largest convention in recent history. An entire day devoted to technical sessions reviewed outstanding developments in the following industries: liquefied petroleum gas, anhydrous ammonia, sulphur dioxide and methyl chloride, medicinal gases, chlorine and oxyacetylene. In addition, Fred C. Mitchell, development engineer of du Pont, discussed "Explosive Ranges of Flammable Liquids," (see *Chem. & Met.*, Dec. 1937, pp. 733 to 736), Harry M. Mabey of Mathieson Alkali reviewed the transportation of compressed gases and Dean C. E. MacQuigg of Ohio State University, formerly research director for Carbide & Carbon, outlined progress made in technical problems affecting transportation and storage equipment. These papers are shortly to be made available to members and other interested companies through the office of the secretary, Frank R. Fetherston, 11 West 42nd St., New York.

New officers elected at the business session include John J. Crowe, of Air Reduction Co., New York, president; and P. F. Lavedan of Liquid Carbonic Corp., and Fred C. Zeisberg of E. I. du Pont de Nemours & Co., vice presidents. An executive board of 28 members was also elected.

In the evening of January 18, the silver anniversary celebration was fittingly closed with the annual banquet in the Jade Room of the Waldorf-Astoria. Mr. John Motley Morehead, former U. S. Minister to Sweden, was toastmaster, and addresses were delivered by Judge Isaac Melson Meekins, of the United States District Court, and E. M. Allen, President of Mathieson Alkali Works. The latter's subject, "Statesmanship in Business", was a forceful plea to put an end to politics when dealing with industry—"the very existence of the citizens of the country." "All industry hesitates," he said, "to go ahead because we know that there must first come a rationalization of federal spending and, of equal importance, the stability of our labor situation. Uncertainty, resulting from broken labor contacts, uncontrolled strikes, coupled with a one-sided, defective national labor act, and the existing tax laws, does not encourage planning and growth on a normal basis. Industry and business generally will continue to follow extremely conservative policies until there is conclusive evidence of a more moderate governmental attitude toward business. There must be a stoppage of attempts to array class against class."

Serious Explosion in Neoprene Plant

The acetylene polymerization building and equipment in the neoprene plant of E. I. du Pont de Nemours & Co. at Deepwater, N. J. was badly damaged by an explosion in a divinylacetylene tank at 3:20 A.M. Sunday, Jan. 23. Since this is a continuous operation, a full crew was at work. Most of the men escaped unharmed, but three of the workmen lost their lives.

Divinylacetylene is a byproduct in the manufacture of neoprene but the damage to the building and equipment must be repaired before production of the major product can be resumed. E. R. Bridgwater, manager of the Rubber Chemicals Division, estimates that the rebuilding will require about three months. "We are confident that we can rebuild in such a manner as to prevent a similar accident in the future and will take the further precaution of isolating the equipment that offers a hazard so that if an explosion should occur, the extent of the damage could not be such as to hold up production for more than a few days."

Investigation has not yet revealed the cause of the explosion. The damage, according to some estimates, will run as high as $200,000. The adjoining building in which chloroprene is converted to neoprene was damaged only slightly since neither chloroprene nor neoprene is explosive or even flammable.

The Rubber Chemicals Division states that it has on hand only two weeks' supply of neoprene which will be divided among various customers in the same proportion that their consumption during the past six months bears to the total. Thus there will be a shortage of neoprene during the reconstruction period which will no doubt seriously handicap the operations of practically all rubber manufacturers who have been using this product in increasing amounts.

Bottled Gas Association Changes Name

At a meeting of members of the National Bottled Gas Association in New York on January 19, the Association voted to change its name to Liquefied Petroleum Gas Association, and adopted appropriate revision of its constitution and by-laws, consistent with the change in name.

The Liquefied Petroleum Gas Association will hold its first meeting, which will be the postponed annual convention of the former society, at St. Louis, Mo. on March 21 and 22.

H. C. Parmelee on Trip to Arctic Circle

Dr. H. C. Parmelee, editorial director of *Engineering and Mining Journal*, and *Metal and Mineral Markets*, left New York Feb. 11 for an inspection of the radium deposits of the Eldorado Gold Mines, Ltd., at Great Bear Lake, 1,000 miles north of Edmonton, Alberta. The party proceeds by train to Edmonton and is there outfitted with furs and suitable arctic clothing before taking the company plane for the two-day trip across the Arctic Circle. Transportation at the mine is by dog-team and sled. Returning in about two weeks, the itinerary also includes a visit to the new radium refinery at Port Hope, Ont. (See *Chem. & Met.* July 1937, pp. 362 ff.)

Sodium Cyanide Development

An authoritative report indicates that sodium cyanide will probably be manufactured on a commercial scale in the New York area during 1938. An important heavy chemical manufacturer has been engaged in large scale development work on the Beilby process which uses as raw material, soda ash, ammonia and carbon.

NEWS FROM WASHINGTON

Washington News Bureau
McGraw-Hill Publishing Co.
Paul Wooton, Chief

COOPERATION is talked, but not practiced, about Washngton. Leaders of business, labor and Government preach the advantage of "cooperation", but seem to define it as "getting the other fellow to do it my way." But the talk has eliminated any panic psychology and, despite several untoward incidents, tempers have been kept well restrained during January.

Congress has continued during January the unproductive debates of the special session. The Senate, snarled in anti-lynching debate, has blocked all legislative progress. The willingness of the members of Congress to allow this condition to persist perhaps proves more conclusively than anything else that the members individually do not know just what legislation they should enact to help business. If they knew what to do, they probably would find a ready parliamentary escape from the Senate filibuster.

International Affairs

Recurring Japanese incidents try the patience of the Administration more than officials like to admit. Congress is vastly more conservative and pacific than the White House, or even the State Department. This, Washington believes, accurately reflects the public sentiment back home. Defeat of the Ludlow amendment during January does not mean that public opinion about war will not determine Congressional action. It will, probably far more than any time in past history.

The only sensible out from many international complications is judged by officials to lie in closer trade and policy affiliation with Britain. Exceptionally rapid progress is being made toward a British trade agreement and the required revision of the Canadian pact. Continued downward revision of tariff rates on a wide variety of process-industry commodities would not surprise Capital City onlookers. The official hope is that Japan, and other aggressor nations, will understand that Britain and the United States will act together on any matter of serious international concern, even those involving armed action. Currently French cabinet and fiscal difficulties give more concern than does Japan.

Mexico has also created serious problems for the State Department lately. The abrupt increase in tariffs announced mid-January led to further vigorous protests through Ambassador Josephus Daniels. Critics of the Administration policy in buying large quantities of Mexican silver, have urged that that agreement be abrogated, in view of the subsequent Mexican actions, characterized as being taken in bad faith. Continuance of the nationalization program is certain to follow an ignoring of the present arbitrary rulings, it is charged; and that means expropriation of large American industrial rights in Mexico, notably petroleum and nonferrous metals.

Down With Monopoly!

Many disturbing rumors have surrounded, during January, the President's proposal to have new legislation limiting monopoly. The Borah-O'Mahoney federal licensing bill was brought back into the spotlight by visits of its co-sponsors to the White House; and the President himself made it clear that limiting monopolies by limiting patent rights was a plan seriously contemplated by him.

The most reliable reports during late January were that the President would recommend to Congress some modification of patent law providing for compulsory licensing of patents. It was at that stage apparently intended that such act would apply to issued patents as well as to those granted in the future. This repudiation of the contract with an inventor might, patent attorneys explain, be permitted by the courts, as somewhat similar limitations on past patents have not been successfully challenged during litigation.

Despite the President's intense desire to strike at monopoly and bigness and holding companies, it is not likely that any very extensive legislation can be enacted during this session of Congress. It is far more likely that these questions will become important campaign issues during the Congressional elections next Summer and Fall.

Preparedness

The War Department is undertaking to set up a definite program of educational orders for the training of industrial establishments in the manufacture of munitions and special wartime equipment. In view of the disturbed world conditions, Congress looks with much greater favor on this program than heretofore. It would not be surprising if some of the orders which can be granted for training purposes would be for important chemical products of military application.

Further attention is also being given to the need for reserves of strategic minerals not adequately available from domestic sources. A special Senate Committee is looking into these matters during February. And the hardy-perennial idea that there should be a domestic tin industry is again blossoming before the House Committee on Foreign Affairs. It is there proposed that a board for strategic materials be created, with general authority, an idea that may receive legislative encouragement.

Chemical Labor

The first national convention of District 50 of U.M.W. in Washington during the week of January 24 provided opportunity for discussion of gas, byproduct coke, and chemical workers' problems. The newly organized unions in this division of process industry were well represented, and it was announced to the cheering delegates by President James Nelson that the coke industry was well organized. But (no cheers) very little work had yet been accomplished in organizing strictly chemical plant workers. The vigorous and continuous efforts of this organization under C.I.O. leadership were evident. Additional organization plans were made for operations during the coming year.

Little progress was made during January in determining what form of investigation of T.V.A. would be authorized. This period of quiet, however, appears to have been merely a lull before the storm. The battle between Lilienthal and A. E. Morgan is likely to break into the open during February. Decision of the three-judge Federal Court, holding T.V.A. "clearly constitutional under the national defense powers," does not modify the Washington program of investigation. That all will not be smooth sailing for the Valley Authority is evident from the sharp cuts made in the House on the appropriations requested for this independent establishment.

The Bureau of Mines has completed and promulgated the regulations under which it will shortly be prepared to produce and sell helium. The Bureau would welcome communications from those who would like to purchase this gas so that they may shortly schedule their plans for production. It will, however, be some weeks yet before the first deliveries can possibly be made, except small quantities of gas from stocks and the first deliveries probably will be for export.

BRITISH INDUSTRIES FAIR STIMULATES TRADING IN CHEMICALS

From Our London Correspondent

TRADE in chemicals in the United Kingdom during the past month has given no indication of the possibility of a slump being experienced in the near future; indeed, in some branches of the chemical industry there has been extra activity. For the British Industries Fair, which will be held in London and in Birmingham during February, there has been a record demand for nearly one million square feet of floor space, and buyers from thirty countries—Holland leading—have already intimated their intention to visit the Fair. Prospects for 1938, according to R. S. Hudson, secretary to the Department of Overseas Trade, are satisfactory; in a New Year message to industry he pointed out that an advance in exports has been achieved side by side with great activity in home trade, resulting in employment of a larger number of people than ever before in the United Kingdom. So far as the past year is concerned the chemical and allied industries have had few matters for serious complaint, possibly the most important having been a certain amount of price cutting by certain chemical products which are imported.

Taking sulphuric acid as an indication of industrial activity so far as the chemical industry is affected, it is to be noted that the actual tonnage of acid made in the United Kingdom during the first six months of 1937 was notably high (564,000 tons) and that for the year 1936-7 (1,077,400 tons) it was the highest recorded for any complete twelve months since 1918. Of sulphuric acid made during the year 1936-7, 205,600 tons were utilized for byproduct ammonium sulphate and 242,100 tons in the manufacture of superphosphate.

Referring to the trade negotiations between the United Kingdom and the United States, Oliver Stanley, president of the Board of Trade, has given industry the assurance that the Import Duties Advisory Committee would be consulted wherever necessary and that, although concessions must necessarily be made, the probable effect of every such concession will be most carefully considered so far as it may affect the interests of industries in the United Kingdom, especially the chemical industry and those industries which are large users of chemicals as raw materials.

The Institution of Petroleum Technologists is busily engaged upon arrangements for the conference on shale and cannel coal which is to be held in Glasgow in June. The outcome of this conference should be materially of great value to Scotland. About twenty papers are to be submitted by authors from at least nine countries, including the United States.

According to the annual report of the Fuel Research Board there is no lessening of the attention which is being paid to problems connected with the utilization of coal. The coal survey is steadily progressing throughout the coal fields of the United Kingdom and preparation of coal for the market is being closely investigated. Production of oil from coal, however, forms the most important part of the program of the Board, and oil production by carbonization, hydrogenation, and synthesis from carbon monoxide and hydrogen are still engaging attention.

The foundation stone of a new works for the production of oil from coal was laid at Bridgend, in the South Wales coal field, just before Christmas. This undertaking, by the South Wales Coalite Co., Ltd., is to cost £650,000, and the plant is expected to be working by autumn of this year. Coal in the adjoining coal fields has been shown to be specially suitable for treatment by low temperature carbonization. In addition to a coal-oil distillation plant the new works will include a large plant for manufacture of tar acids and other chemical products, and from 500 to 750 tons of coal will pass through the process per day.

In the chemical and chemical-using industries many new enterprises are now in progress. A wool pulp factory, sponsored by a continental concern, is to be established in Cumberland at an estimated cost of about £700,000, and transparent paper, among other kinds, will be made. Oxygen of exceptionally high purity is to be made at a new Clydeside works in Scotland (Saturn Oxygen Co., Ltd.); the drying of the oxygen before it is put into cylinders will be a special feature. Duffield Coal Products, Ltd., has just announced that it intends to engage in the manufacture of methyl alcohol, and works are to be established in the United Kingdom and in the Dominions. Manchester Oil Refineries, Ltd., hope to have a new refinery ready early in March; part of the plant has been supplied by a firm in Berlin, and its arrival in England has been duly announced.

On the finer side of chemical manufacture it is interesting to note that ionone of 100 per cent purity, the refinement of a new manufacturing technique, has just been introduced by A. Boake Roberts & Co., Ltd., of London, under the trade name of Centanone; it is claimed that the initial odor of this product is maintained throughout its long period of volatilization. British Industrial Plastics, Ltd., manufacturers of Beetle molding powders, has introduced a new powder for the production of transparent moldings, and has also increased the range of its lacquer resins.

CALENDAR

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY, annual meeting, New York City, February 21–24.

AMERICAN CERAMIC SOCIETY, New Orleans, La., March 27–April 2.

AMERICAN CHEMICAL SOCIETY, semi-annual meeting, Dallas, Texas, April 18–21.

ELECTROCHEMICAL SOCIETY, Savannah, Ga., April 27–30.

TENTH INTERNATIONAL CONGRESS OF CHEMISTRY, Rome, Italy, May 16–21.

AMERICAN PETROLEUM INSTITUTE, mid-year meeting, Wichita, Kansas, May 23–25.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, semi-annual meeting, White Sulphur Springs, W. Va., May 9–11.

SOCIETY OF CHEMICAL INDUSTRY, annual meeting of all sections, Ottawa, Canada, June 20–22.

Chemical Engineering School At Cornell

The establishment of a school of Chemical Engineering, as the fourth constituent unit of the College of Engineering at Cornell University was announced Jan. 31 by President Edmund Ezra Day, following ratification of the Board of Trustees at its winter meeting held in New York City on Jan. 29. Dr. F. H. Rhodes, since 1920 professor of chemistry and chemical engineering at Cornell was named director of the new school, effective July 1. The curriculum will consist of a five-year course leading to the new degree of Bachelor of Chemical Engineering.

Cornell's chemical engineering curriculum is approved by the Engineering Council for Professional Development and the American Institute of Chemical Engineers.

INDUSTRIAL CHEMICALS

	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.05½–$0.06½	$0.05½–$0.06½	$0.07 –$0.08
Acid, acetic, 28%, bbl., cwt.	2.23 – 2.48	2.23 – 2.48	2.25 – 2.50
Glacial 99%, drums	8.43 – 8.68	8.43 – 8.68	8.43 – 8.68
U. S. P. reagent	10.25 –10.50	10.25 –10.50	10.52 –10.77
Boric, bbl., ton	105.00–115.00	105.00–115.00	105.00–115.00
Citric, kegs, lb.	.24 – .27	.24 – .27	.25 – .28
Formic, bbl., ton	.10½– .11	.10½– .11	.11 – .11½
Gallic, tech., bbl., lb.	.75 – .78	.75 – .78	.60 – .65
Hydrofluoric 30% carb., lb.	.07 – .07½	.07 – .07½	.07 – .07½
Lactic, 44%, tech., light, bbl., lb.	.06½– .06¾	.06½– .06¾	.6½ – .6¾
Muriatic, 18°, tanks, cwt.	1.05 –.....	1.05 –.....	1.00 – 1.10
Nitric, 36°, carboys, lb.	.05 – .05½	.05 – .05½	.05 – .05½
Oleum, tanks, wks., ton	18.50 –20.00	18.50 –.....	18.50 –20.00
Oxalic, crystals, bbl., lb.	.10½– .12	.10½– .12	.10½– .12
Phosphoric, tech., c'bys., lb.	.09 – .10	.09 – .10	.09 – .10
Sulphuric, 60°, tanks, ton	13.00 –.....	13.00 –.....	11.00 –11.50
Sulphuric, 66°, tanks, ton	16.50 –.....	16.50 –.....	15.50 –.....
Tannic, tech., bbl., lb.	.40 – .45	.40 – .45	.20 – .30
Tartaric, powd., bbl., lb.	.24½– .25¾	.24½– .25¾	.21½– .22¾
Tungstic, bbl., lb.	2.75 –.....	2.75 –.....	2.50 – 2.75
Alcohol, Amyl	–.....	–.....	–.....
From Pentane, tanks, lb.	.123–.....	.123–.....	.123–.....
Alcohol, Butyl, tanks, lb.	.08¾–.....	.08¾–.....	.08¾–.....
Alcohol, Ethyl, 190p'f., bbl., gal.	4.14 –.....	4.14 –.....	4.14 –.....
Denatured, 190 proof			
No. 1 special, dr., gal wks.	.34 –.....	.34 –.....	.32 –.....
Alum, ammonia, lump, bbl., lb.	.03½– .04	.03½– .04	.03 – .04
Potash, lump, bbl., lb.	.03½– .04	.03½– .04	.03 – .04
Aluminum sulphate, com bags cwt.	1.35 – 1.50	1.35 – 1.50	1.35 – 1.50
Iron free, bg., cwt.	2.00 – 2.25	2.00 – 2.25	2.00 – 2.25
Aqua ammonia, 26°, drums, lb.	.02½– .03	.02½– .03	.02½– .03
tanks, lb.	.02½– .02¾	.02½– .02¾	.02½– .02¾
Ammonia, anhydrous, cyl., lb.	.15½–.....	.15½–.....	.15½– .16
tanks, lb.	.04½–.....	.04½–.....	.04½–.....
Ammonium carbonate, powd tech., casks, lb.	.08 – .12	.08 – .12	.08 – .12
Sulphate, wks., cwt.	1.475–.....	1.425–.....	1.35 –.....
Amylacetate tech., tanks, lb.	.11½– .12	.11½– .12	.11 – .11½
Antimony Oxide, bbl., lb.	.12½– .13	.15 – .15½	.14 – .14½
Arsenic, white, powd., bbl., lb.	.03 – .03¼	.03 – .03¼	.03½– .04
Red, powd., kegs, lb.	.15½– .16	.15½– .16	.15½– .16
Barium carbonate, bbl., ton	52.50 –57 50	52 50 –57.50	56.50 –58.00
Chloride, bbl., ton	79.00 –81.00	79.00 –81.00	72.00 –74.00
Nitrate, cask, lb.	.07 – .08	.07 – .08	.08½– .09
Blanc fixe, dry, bbl., lb.	.03½– .04	.03½– .04	.03½– .04
Bleaching powder, f. o b., wks., drums, cwt.	2.00 – 2.10	2.00 – 2.10	2.00 – 2.10
Borax, gran., bags, ton	46.00 –51.00	46.00 –51.00	44.00 –49.00
Bromine, cs., lb.	.30 – .32	.30 – .32	.36 – .38
Calcium acetate, bags	1.65 –.....	1.65 –.....	2.10 –.....
Arsenate, dr., lb.	.06½– .07	.06½– .07	.06½– .07
Carbide drums, lb.	.05 – .06	.05 – .06	.05 – .06
Chloride, fused, dr., del., ton	21.50 –24.50	21.50 –24.50	20.00 –33.00
flake, dr., del., ton	23.00 –25.00	23.00 –25.00	22.00 –35.00
Phosphate, bbl., lb.	.07½– .08	.07½– .08	.07½– .08
Carbon bisulphide, drums, lb.	.05 – .06	.05 – .06	.05½– .06
Tetrachloride drums, lb.	.05½– .08½	.05½– .06	.05½– .06
Chlorine, liquid, tanks, wks., lb.	2.15 –.....	2.15 –.....	2.15 –.....
Cylinders	.05½– .06	.05½– .06	.05½– .06
Cobalt oxide, cans, lb.	1.67 – 1.70	1.67 – 1.70	1.41 – 1.51
Copperas, bgs., f.o.b., wks., ton	15.00 –16.00	15.00 –16.00	15.00 –16.00
Copper carbonate, bbl., lb.	.09 – .16¼	.09 – .16¼	.11¼– 16
Sulphate, bbl., cwt.	4 25 – 4.50	4.50 – 4.75	4.85 – 5.10
Cream of tartar, bbl., lb.	.19½– .20	.19½– .20	.15 – .15½
Diethylene glycol, dr., lb.	.22 – .23	.22 – .23	.16½– .20½
Epsom salt, dom., tech., bbl., cwt.	1.80 – 2.00	1.80 – 2.00	1.80– 2.00
Ethyl acetate, drums, lb.	.06½–.....	.06½–.....	.07 –.....
Formaldehyde, 40%, bbl., lb.	.05½– .06½	.05½– .06½	.05½– .6½
Furfural, dr., lb.	.10 – .17¾	.10 – .17¾	.10 – .17¾
Fusel oil, ref. drums, lb.	.16 – .18	.16 – .18	.16 – .18
Glaubers salt, bags, cwt.	.95 – 1.00	.95 – 1.00	.85 – 1.00
Glycerine, c.p., drums, extra, lb.	.15½–.....	.15½–.....	.29 –.....
Lead:			
White, basic carbonate, dry casks, lb.	.06½–.....	.06½–.....	.07½–.....
White, basic sulphate, sck., lb.	.06½–.....	.06½–.....	.06½–.....
Red, dry, sck, lb.	.074–.....	.0735–.....	.085–.....
Lead acetate, white crys., bbl., lb.	.11 – .12	.11 – .12	.11 – .11½
Lead arsenate, powd., bbl., lb.	.13 – .13¼	.13 – .13¼	.09½– .10
Lime, chem., bulk, ton	8.50 –.....	8.50 –.....	8.50 –.....
Litharge, pwd., csk., lb.	.06 –	.0635–.....	.07½–.....
Lithophone, bags, lb.	.04½– .04¾	.04½– .04¾	.04½– .05
Magnesium carb., tech., bags, lb.	.06 – .06½	.06 – .06½	.06 – .06½

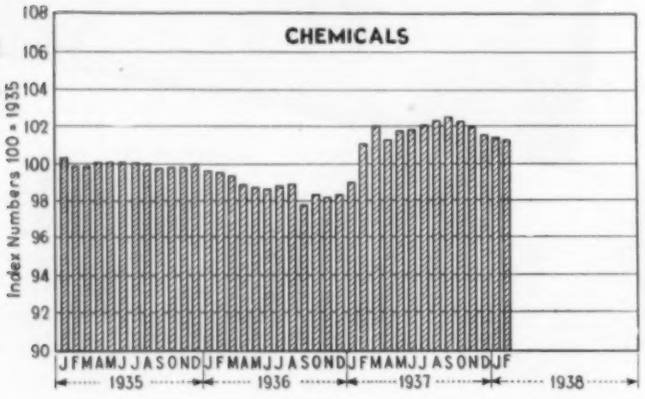
	Current Price	Last Month	Last Year
Methanol, 95%, tanks, gal.	.31 –.....	.31 –.....	.31 –.....
97%, tanks, gal.	.32 –.....	.32 –.....	.32 –.....
Synthetic, tanks, gal.	.33 –.....	.33 –.....	.33 –.....
Nickel salt, double, bbl., lb.	.13 – .13½	.13 – .13½	.13 – .13½
Orange mineral, csk., lb.	.10½–.....	.10½–.....	.11½–.....
Phosphorus, red, cases, lb.	.40 – .42	.40 – .42	.40 – .42
Yellow, cases, lb.	.24 – .30	.24 – .30	.28 – .32
Potassium bichromate, casks, lb.	.08½– .09	.08½– .09	.08½– .09
Carbonate, 80–85%, calc. csk., lb.	.06½–.....	.06½–.....	.07 – .07½
Chlorate, powd., lb.	.09½–.....	.09½– .09	.08 – .08½
Hydroxide (c'stic potash) dr., lb.	.07 – .07½	.07 – .07½	.07 – .07½
Muriate, 80% bgs., ton	23.00 –.....	23.00 –.....	23.00 –.....
Nitrate, bbl. lb.	.05½– .06	.05½– .06	.05½– .06
Permanganate, drums, lb.	.18½– .19	.18½– .19	.18½– .19
Prussiate, yellow, casks, lb.	.15 – .16	.15 – .16	.16 – .17
Sal ammoniac, white, casks, lb.	.05 – .05½	.05 – .05½	.04½– .05
Salsoda, bbl., cwt.	1.00 – 1.05	1.00 – 1.05	1.00 – 1.05
Salt cake, bulk, ton	13.00 –15.00	13.00 –15.00	13.00 –15.00
Soda ash, light, 58%, bags, contract, cwt.	1.23 –.....	1.23 –.....	1.23 –.....
Dense, bags, cwt.	1.25 –.....	1.25 –.....	1.25 –.....
Soda, caustic, 76%, solid, drums, contract, cwt.	2.60 – 3.00	2.60 – 3.00	2.60 – 3.00
Acetate, works, bbl., lb.	.04½– .05	.04½– .05	.04½– .05
Bicarbonate, bbl., cwt.	1.75 – 2.00	1.75 – 2.00	1.75 – 2.00
Bichromate, casks, lb.	.06½– .07	.06½– .07	.06½– .07
Bisulphate, bulk, ton	15.00 –16.00	15.00 –16.00	15.00 –16.00
Bisulphite, bbl., lb.	.03½– .04	.03½– .04	.03½– .04
Chlorate, kegs, lb.	.06½– .06¾	.06½– .06¾	.06½– .06¾
Chloride, tech., ton	12.00 –14.75	12.00 –14.75	12.00 –14.75
Cyanide, cases, dom., lb.	.16½– .17	.16½– .17	.15½– .16
Fluoride, bbl., lb.	.07½– .08	.07½– .08	.07½– .08
Hyposulphite, bbl., cwt.	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Metasilicate, bbl., cwt.	2.15 – 3.15	2.15 – 3.15	2.15 – 3.15
Nitrate, bags, cwt.	1.45 –.....	1.45 –.....	1.375–.....
Nitrite, casks, lb.	.07 – .08	.07 – .08	.07½– .08
Phosphate, dibasic, bags, lb.	1.85 –.....	1.85 –.....	.022– .024
Prussiate, yel. drums, lb.	.10 – .11	.10– .11	.10 – .11
Silicate (40° dr.) wks., cwt.	.80 – .85	.80 – .85	.80 – .85
Sulphide, fused, 60–62%, dr., lb.	.02½– .03¼	.02½– .03	.02½– .03
Sulphite, cyrs., bbl., lb.	.02½– .02¾	.02½– .02¾	.02½– .02¾
Sulphur, crude at mine, bulk, ton	18.00 –.....	18.00 –.....	18.00– .....
Chloride, dr., lb.	.03 – .04	.03 – .04	.03½– .04
Dioxide, cyl., lb.	.07 – .08	.06½– .08	.07 – .07½
Flour, bag, cwt.	1.60 – 3.00	1.60 – 3.00	1.60 – 3.00
Tin Oxide, bbl., lb.	.47 –.....	.48 –.....	.54 –.....
Crystals, bbl., lb.	.33 –.....	.34 –.....	.37½–.....
Zinc. chloride, gran., bbl., lb.	.05 – .06	.05 – .06	.05 – .06
Carbonate, bbl., lb.	.14 – .15	.14 – .15	.09 – .11
Cyanide, dr., lb.	.36 – .38	.36 – .38	.36 – .38
Dust, bbl., lb.	.06½–.....	.075–.....	.079–.....
Zinc oxide, lead free, bag., lb.	.06½–.....	.06½–.....	.05½–.....
5% lead sulphate, bags, lb.	.06½–.....	.06½–.....	.05½–.....
Sulphate, bbl., cwt.	3.15 – 3.60	3.15 – 3.60	2.65 – 3.00

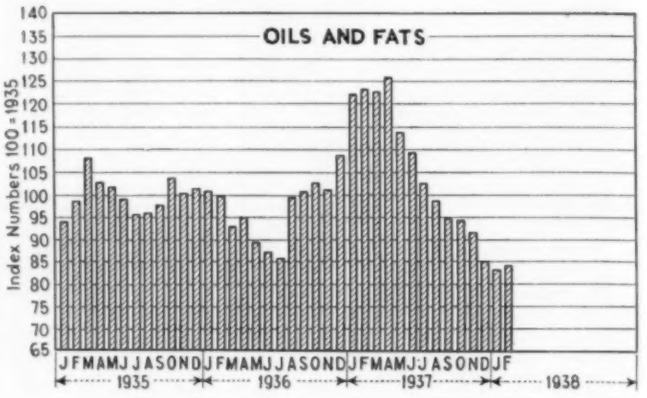
The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to February 14

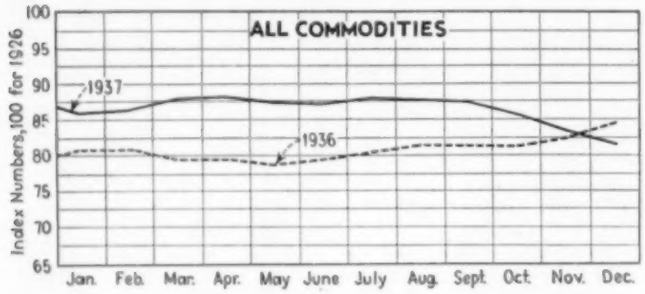
OILS AND FATS

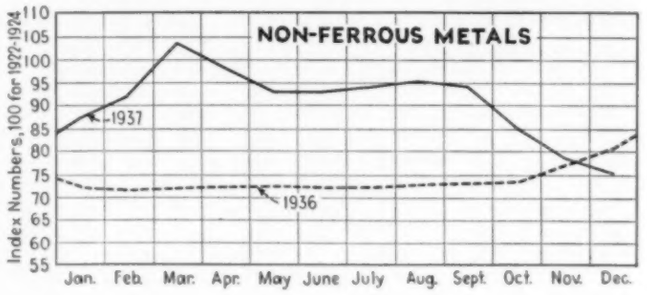
	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb.	$0.09½–$0.10	$0.09½–$0.10	$0.10½–$0.11
Chinawood oil, bbl., lb.	.15 –.....	.15½–.....	.15½–.....
Coconut oil, Ceylon, tanks, N. Y. lb.	.03½–.....	.04½–.....	.08½–.....
Corn oil crude, tanks (f.o.b. mill), lb.	.07¼	.06½–.....	.10½–.....
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.06½–.....	.06 –.....	.10 –.....
Linseed oil, raw car lots, bbl., lb.	.099–.....	.102–.....	.099–.....
Palm, casks, lb.	.04½–.....	.04 –.....	.06½–.....
Peanut oil, crude, tanks (mill), lb.	.06½–.....	.06½–.....	.10½–.....
Rapeseed oil, refined, bbl., gal.	.90 –.....	.90 –.....	.85 –.....
Soya bean, tank, lb.	.06½–.....	.06 –.....	.10 –.....
Sulphur (olive foots), bbl., lb.	.09½–.....	.08 –.....	.11½–.....
Cod, Newfoundland, bbl., gal.	52 –.....	.52 –.....	.42 –.....
Menhaden, light pressed, bbl., lb.	.074–.....	.074–.....	.084–.....
Crude, tanks (f.o.b. factory), gal.	.37½–.....	.37½–.....	.37 –.....
Grease, yellow, loose, lb.	.04½–.....	.04½–.....	.08½–.....
Oleo stearine, lb.	.07½–.....	.09 –.....	.10½–.....
Oleo oil, No. 1	.09½–.....	.10½–.....	.14½–.....
Red oil, distilled, d.p. bbl., lb.	.09½–.....	.09½–.....	.10½–.....
Tallow extra, loose, lb.	.05½–.....	.06½–.....	.08½–.....

CHEM. & MET.'S WEIGHTED PRICE INDEXES









COAL-TAR PRODUCTS

	Current Price	Last Month	Last Year
Alpha-napthol, crude bbl., lb.	$0.52 -$0.55	$0.52 -$0.55	$0.60 -$0.62
Alpha-naphthylamine, bbl., lb.	.32 - .34	.32 - .34	.32 - .34
Aniline oil, drums, extra, lb.	.15 - .16	.15 - .16	.15 - .16
Aniline salts, bbl., lb.	.22 - .24	.22 - .24	.24 - .25
Benzaldehyde, U.S.P., dr., lb.	.85 - .95	.85 - .95	1.10 - 1.25
Benzidine base, bbl., lb.	.70 - .75	.70 - .75	.65 - .67
Benzoic acid, U.S.P., kgs., lb.	.52 - .54	.52 - .54	.48 - .52
Benzyl chloride, tech., dr., lb.	.25 - .27	.25 - .27	.30 - .35
Benzol, 90%, tanks, works, gal.	.16 - .18	.16 - .18	.16 - .18
Beta-napthol, tech., drums, lb.	.23 - .24	.23 - .24	.23 - .24
Cresol, U.S.P., dr., lb.	.12 - .13	.12 - .13	.10 - .11
Cresylic acid, 99%, dr., wks., gal.	.89 - .92	.89 - .92	.73 - .75
Diethylaniline, dr., lb.	.40 - .45	.40 - .45	.55 - .58
Dinitrophenol, bbl., lb.	.23 - .25	.23 - .25	.29 - .30
Dinitrotoluen, bbl., lb.	.15 - .16	.15 - .16	.16 - .17
Dip oil, 15%, dr., gal.	.23 - .25	.23 - .25	.23 - .25
Diphenylamine, bbl., lb.	.32 - .36	.32 - .36	.38 - .40
H-acid, bbl., lb.	.50 - .55	.50 - .55	.65 - .70
Naphthalene, flake, bbl., lb.	.07½- .07¾	.07½- .07¾	.07½- .07¾
Nitrobensene, dr., lb.	.08 - .09	.08 - .09	.08¾- .10
Para-nitraniline, bbl., lb.	.50 - .52	.50 - .52	.45 - .47
Phenol, U.S.P., drums, lb.	.14½-.....	.14½-.....	.13½- .14
Picric acid, bbl., lb.	.35 - .40	.35 - .40	.30 - .40
Pyridine, dr., gal.	1.55 - 1.60	1.55 - 1.60	1.10 - 1.15
Resorcinal, tech., kegs, lb.	.75 - .80	.75 - .80	.65 - .70
Salicylic acid, tech., bbl., lb.	.33 - .40	.34 - .40	.40 - .42
Solvent naptha, w.w., tanks, gal.	.30 -.....	.30 -.....	.26 -.....
Toluidine, bbl., lb.	.88 - .90	.88 - .90	.88 - .90
Toluene, tanks, works, gal.	.35 -.....	.35 -.....	.30 -.....
Xylene, com, tanks, gal.	.35 -.....	.35 -.....	.30 -.....

MISCELLANEOUS

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton.	$22.00-$25.00	$22.00-$25.00	$22.00-$25.00
Casein, tech., bbl., lb.	.09½- .12	.10½- .12	.19 - .21
China clay, dom., f.o.b. mine, ton.	8.00 -20.00	8.00 -20.00	8.00 -20.00
Dry colors:			
Carbon gas, black (wks.), lb.	.02½- .30	.0295- .30	.04 - 30
Prussian blue, bbl., lb.	.36 - .37	.36 - .37	.37 - 38
Ultramarine blue, bbl., lb.	.10 - .26	.10 - .26	.10 - .26
Chrome green, bbl., lb.	.21 - .30	.21 - .30	.26 - .27
Carmine red, tins, lb.	4.00 - 4.40	4.00 - 4.40	4.00 - 4 40
Para toner, lb.	.75 - .80	.75 - .80	.75 - 80
Vermilion, English, bbl., lb.	1.55 - 1.60	1.60 - 1.65	1.69 - 1 72
Chrome yellow, C. P., bbl., lb.	.14½- .15½	.14½- .15½	.12 - 14
Feldspar, No. 1 (f.o.b. N.C.), ton.	6.50 - 7.50	6.50 - 7.50	6.50 - 7 50
Graphite, Ceylon, lump, bbl., lb.	.06 - .06½	.06 - .06½	.07 - .08½
Gum copal Congo, bags, lb.	.08 - .30	.08 - .30	.08 - .30
Manila, bags, lb.	.08½- .14	.08½- .14	.09 - .14
Damar, Batavia, cases, lb.	.16 - .24	.16 - .24	.15½- .16
Kauri cases, lb.	.18½- .60	.18½- .60	.19 - .25
Kieselguhr (f.o.b. N. Y.), ton.	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc, ton	50.00 -.....	50.00 -.....	50.00 -.....
Pumice stone, lump, bbl., lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks, lb.	.03 - .04	.03 - .04	.03 - .04
Rosin, H., bbl.	7.05 -.....	7.20 -.....	10.80 -.....
Turpentine, gal.	.31 -.....	.32½-.....	.47 -.....
Shellac, orange, fine, bags, lb.	.21 -.....	.21 -.....	.25 -.....
Bleached, bonedry, bags, lb.	.17 -.....	.17 -.....	.21 -.....
T. N. Bags, lb.	.12 -.....	.12 -.....	.14 -.....
Soapstone (f.o.b. Vt.), bags, ton.	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.), ton.	8.00 - 8.50	8.00 - 8.50	8.00 - 8 50
300 mesh (f.o.b. Ga.), ton.	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N. Y.), ton.	13.75 -.....	13.75 -.....	13.75 -.....

INDUSTRIAL NOTES

THE MULLITE REFRACTORIES CO., Shelton, Conn., has moved George T. Hubbell from the home office to act as district representative for the State of Michigan.

KEADY & MATTISON CO., Ambler, Pa., has appointed The American Cyanamid and Chemical Corp. exclusive distributors for its magnesia compounds.

NUNDET CORK CORP. has transferred its New York sales office from 450 Seventh Ave. to its main office, 65 South 11th St., Brooklyn, N. Y.

ETHYL EXPORT CORP., subsidiary of Ethyl Gasoline Corp., New York, has elected Ralph C. Champlain, vice-president.

STANDARD ALCOHOL CO., New York, has moved its offices from 2 Park Ave. to 26 Broadway. James G. Park is sales manager.

ATLAS POWDER CO., Wilmington, Del., has placed J. H. Buchanan in charge of its new sales office at 135 So. La Salle St., Chicago.

GRAVER TANK & MFG. CO., INC., East Chicago, Ind., has enlarged its manufacturing plant at Catasauqua, Pa., by the addition of new buildings.

WORTHINGTON PUMP AND MACHINERY CORP., Harrison, N. J., has acquired an interest in the Moore Steam Turbine Corp., Wellsville, N. Y.

New CONSTRUCTION

Where Plants Are Being Built in Process Industries

	Current Projects		Cumulative 1938	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	$40,000	$40,000	$40,000
Middle Atlantic	$1,210,000	1,280,000	1,519,000	80,000
South	5,220,000	1,180,000	5,600,000	1,240,000
Middle West	9,240,000	1,250,000	9,370,000	1,700,000
West of Mississippi	795,000	500,000	1,580,000	4,380,000
Far West	50,000	1,772,000	90,000	1,772,000
Canada	75,000	40,000	1,095,000	40,000
Total	$16,590,000	$6,062,000	$19,294,000	$9,252,00

PROPOSED WORK

Cement Plant—Cotton States Portland Cement Co., Jackson, Miss., plans to construct a modern cement plant for the manufacture of Portland cement from lime deposits recently purchased in Noxubee County, Macon, Miss.

Cotton Oil Mill—Cox Bros., Gurdon, Ark., plan to construction a large cotton oil mill at Malvern, Ark.

Cotton Oil Plant—Rule-Jayton Cotton Oil Co., Stamford, Tex., plans alterations and repairs to its seed house and cleaning equipment. Estimated cost including equipment $40,000.

Creosoting Plant—W. H. Griffin, Okmulgee, Okla., is having preliminary plans prepared for a timber creosoting plant at Muskogee, Okla. Estimated cost $100,000.

Distillery—Cedar Valley Distillery Co., Wooster, O., plans to construct a 5 story bottling plant at its distillery. Estimated cost will exceed $50,000.

Factory—Air Reduction Sales Co., 3101 Homan Ave., Chicago, Ill., contemplates the construction of a factory.

Factory—Electro Metallurgical Co., 137 47th St., Niagara Falls, N. Y., subsidiary of the Union Carbide Co. plans to construct a factory at Tuscumbia, Ala. Maturity indefinite.

Factory—Metropolitan Paving Brick Co., Renkert Bldg., Canton, O., plans to construct a 1 story, 50x70 ft. factory to be used as shading and grading department for new line of tile adapted for interior use. Estimated cost including machinery $50,000.

Factory—Rogers Galvanizing Co., A. T. Rogers, owner, 611 Marshall St., Houston, Tex., has acquired a site of 3.3 acres near Eureka Junction and plans to construct a factory. Estimated cost $75,000.

Factory—Spencer Lens Co., Doat St., Buffalo, N. Y., has acquired a site on Eggert Rd., Cheektowaga, N. Y., and plans to construct a factory. Estimated cost will exceed $40,000.

Factory—Timken Roller Bearing Co., Canton, O., plans to enlarge its soaking pits and install central oxygen plant in connection with extension of melting shop. Estimated cost $450,000.

Factory—Welding Gas Products Co., c/o J. D. Williams, Gen. Mgr., 1410 Cowart St., Chattanooga, Tenn., recently incorporated for $200,000, plans to construct a factory for the manufacture of oxygen and hydrogen to have a capacity of 600,000 cu. ft. of oxygen a month. Estimated cost including equipment $100,000.

Fertilizer Factory—Bone Dry Fertilizer Co., 19th and Dock Sts., Richmond, Va., contemplates the construction of a fertilizer factory. Estimated cost including equipment $40,000.

Glass Factory—Sterling Glass Co., Lapel, Ind., plans new steel tanks for glass plants and other changes to its plant structures. Estimated cost including equipment $50,000.

Glass Factory—United States Glass Co., Edwin E. Slick, Chn. of Bd., South 9th and Bingham Sts., S.S., Pittsburgh, Pa., contemplates alterations to its plant at Glassport, Pa., including new lehrs batch tanks and modernization of equipment. H. D. Allen, Ch. Engr. Maturity indefinite.

Insulating Plant—F. E. Schundler & Co., Inc., Mills Rd., Joliet, Ill., plans to construct a 1 and 2 story, 90x162 ft. insulating plant, to replace the one recently destroyed by fire. Estimated cost $100,000.

Laboratory—Lamotte Chemical Co., 414 Light St., Baltimore, Md., is having plans prepared by O. E. Adams, Archt., 329 North Charles St., Baltimore, and will take bids about February 15 for the construction of a laboratory at Lutherville, Md. Estimated cost $40,000.

Laboratory—Petroleum Refining Co. of California, Petroleum Bldg., Houston, Tex., plans to construct a 2 story, 34x95 ft. laboratory. Wirtz & Calhoun, 500 Stewart St., Houston, Archts. Estimated cost $40,000.

Laboratory—Refrigeration & Air Conditioning Institute, 2150 West Lawrence Ave., Chicago, Ill., plans to construct a laboratory. Revised bids for a 3 story, 56x100x 250 ft. structure are now being received by Pereira & Pereira, Archts., 221 North La Salle St. Estimated cost $100,000.

Laboratory—U. S. Department of Agriculture and Michigan State College, East Lansing, Mich., plan to construct a regional poultry research laboratory on the campus of Michigan State College. Estimated cost $250,000.

Lead Factory—St. Joseph Lead Co., 250 Park Ave., New York, N. Y., plans improvements to its plant and properties near Josephtown, Pa. Estimated cost will exceed $40,000.

Oil Refinery—J. L. Belanger, First Ave., Quebec City, Que., Can., plans to construct an oil refinery. Estimated cost $75,000.

Oil Refinery—Sun Oil Co., 1608 Walnut St., Philadelphia, Pa., plans improvements to its refineries at Marcus Hook, Pa., and Toledo, O. Estimated cost $1,000,000 each. This is part of $11,000,000 expansion program for 1938.

Newsprint Mill—Georgia Chamber of Commerce, H. Hallman, Pres., Atlanta, Ga., and a joint committee of the legislature named to investigate the pulpwood industry, will introduce a bill in the legislature to create the Georgia Wood Pulp Development & Conservation Authority, as a public corporation, to construct a newsprint mill in Middle Georgia. Exact location of the mill has not been determined but many middle Georgia towns have in bids. Most probable point is where Oconee and Ocmulgee Rivers converge to form the Altamaha, so that many growers could transport wood by raft at small cost. The Authority would issue state bonds amounting to $5,000,000 to defray cost.

Paint Factory—Tremco Manufacturing Co., W. E. Thenhaft, Pres., East 131st St. and Taft Ave., Cleveland, O., contemplates the construction of a 1 story paint factory. Estimated cost $150,000.

Pilchard Reduction Plant—J. R. Gisler, M. R. Wallace and associates, 340 Pine St., San Francisco, Calif., plan to construct a 1 story, 50x150 ft. pilchard reduction plant at Aberdeen, Wash. Estimated cost $50,000.

Power Alcohol Plant—Chemical Foundation of Kansas, c/o Chemical Foundation, Inc., 654 Madison Ave., New York, N. Y., plans to construct a plant for the manufacture of power alcohol and by-products from farm products, in Sioux City, Iowa The Company also operates a power alcohol plant at Atchison, Kan. Estimated cost $500,000.

Rubber Factory—Alligator Rubber Products Co., 110 Lillie St., Newark, N. J., plans to construct a 1 story factory. Estimated cost $50,000.

Rayon Mill—Industrial Rayon Corp., Hiram Rivitz, Pres., West 98th St. and Walford Ave., Cleveland, O., contemplates the construction of a rayon mill at a site which has not yet been determined. Estimated cost $7,000,000.

CONTRACTS AWARDED

Carbon Black Plant—Magnolia Petroleum Co., Magnolia St., Oklahoma City, Okla., will construct a carbon black plant in Pontotoc County, Stonewall, Okla. Work will be done by day labor under supervision of owner's engineering department. $500,000.

Coke Ovens—Republic Steel Corp., Youngstown, O., has awarded the contract for 69 coke ovens of the latest type with self-sealing doors and a capacity of 12 tons of coke each, at its plant here to Koppers Co., Koppers Bldg., Pittsburgh, Pa. In addition to this improvement additional equipment will be added and repairs will be made to coke product plant. Estimated cost $1,250,000.

Coke Ovens—Dominion Steel & Coal Corp., Sydney, N. S., Can., has awarded the contract for modernizing its light oil recovery plant at its coke ovens to Koppers Co., Koppers Bldg., Pittsburgh, Pa.

Laboratory—Hartford Empire Co., 333 Homestead Ave., Hartford, Conn., has awarded the contract for a 2 story, 42x75 ft. addition to its experimental laboratory to Industrial Construction Co., 721 Main St., Hartford. Estimated cost $40,000.

Paint Factory—National Paint & Varnish Co., 1950 East First St., Los Angeles, Calif., will construct a 1 and part 2 story, 80x160 ft. and 20x90 ft. factory and office building. Work will be done by owner under supervision of George Smith, Supt. of Constr. Estimated cost $40,000.

Pulverizing Plant—Congoleum Nairn Co., Inc., 195 Belgrove Dr., Kearny, N. J., has awarded the contract for a pulverizing plant to Enstice Bros., 895 Frelinghuysen Ave., Newark.

Rayon Mill—American Enka Corp., Enka, N. C., has awarded the contract for an addition to its chemical building to Potter & Shackelford, Inc., Greenville, S. C.

Rayon Mill—Rayonier Mills, Inc., Fernandina, Fla., recently incorporated, a division of the Fernandina Pulp & Paper Co., Fernandina, is building a rayon process mill, using the semi-finished product from the Fernandina mill. Work is now under way by Rust Engineering Co., Clark Bldg., Pittsburgh, Pa. Estimated cost $1,000,000.

Refinery—General Petroleum Co., 108 West Second St., Los Angeles, Calif., has awarded the contract for a refinery unit and tanks at Torrance, Calif., to Lummis Co., 420 Lexington Ave., New York, N. Y. Estimated cost $1,732,000.

Refinery—Gulf Oil Corporation, c/o Charles D. Buerger, Gulf Bldg., Pittsburgh, Pa., will construct an Iso-Octane unit to have a capacity of 3,500 bbl. gasoline daily and 15,000,000 cu. ft. Iso-Octane daily. Work will be done by separate contracts. Estimated cost $1,200,000.

Refinery—Southwestern Oil & Refining Co., Lake Charles, La., will construct an oil refinery on the Calcasieu Ship Channel at Lake Charles. Work will be done by owner. Estimated cost $100,000.

Storage Building—Central Franklin Processing Co., Holzclaw Ave., Chattanooga, Tenn., has awarded the contract for a storage building to Mark K. Wilson Co., Power Bldg., Chattanooga. Estimated cost $40,000.

Warehouse—Atlantic Refining Co., Chamber of Commerce Bldg., Pittsburgh, Pa., has awarded the contract for a warehouse, salvage building and machine shop to David T. Riffle, 1006 Forbes St., Pittsburgh. Estimated cost $40,000.

Exports of Chemicals Showed Marked Gain Over Preceding Years

UNITED STATES exports of chemicals and related materials continued to advance last year with the recorded aggregate value reaching the highest point attained in seven years, according to Department of Commerce compilations.

Preliminary estimates indicate that the value of such exports exceeded $181,000,000 in 1937, which was 17½ per cent above the $154,000,000 recorded during the preceding year, and compares with $136,677,000 in 1935, $124,275,000 in 1934, and $107,352,000 in 1933.

The term "chemicals and related products" as used above goes outside the classification of group 8 as it appears in the monthly summaries of foreign commerce. Group 8 includes the following subdivisions: Coal-tar products; medicinal and pharmaceutical preparations; industrial chemical specialties; industrial chemicals; pigments, paints and varnishes; fertilizers and fertilizer materials; explosives; and soap and toilet preparations. Exports according to this grouping—with the exception of explosives, data for which are not yet available—were valued at $135,584,00 in 1937, $114,331,000 in 1936, $101,054,000 in 1935, $90,469,000 in 1934, and $75,213,000 in 1933. There has been, therefore, a steady rise in exports of chemicals from 1933 to date. In terms of per cent, 1937 export shipments exceeded 1936 by about 18.6 per cent; 1935 by more than 34 per cent; 1934 by close to 50 per cent; and 1933 by more than 80 per cent.

Comparing 1937 with the preceding year, it is found that increases in outward shipments were general for all subdivisions of group 8 with the exception of fertilizers and fertilizer materials where a decline was recorded. This was the result of reduced shipments of sulphate of ammonia and phosphate rock.

The largest gain in exports was made by industrial chemical specialties which now holds the ranking position in the group. The value of such shipments, $27,526,000, has more than doubled in two years. Among the items prominent in the export trade of this group are; insecticides, fungicides, and disinfectants; pyroxylin and products; petroleum jelly; and synthetic gums and resins.

In second place came industrial chemicals with a total valuation of $27,505,000 which represented an increase of about 24.5 per cent over the 1936 total. Sodium compounds contributed a large part of this total with shipments going from 512 million pounds in 1936 to 703 million pounds in 1937. Borate of soda was especially prominent in export trade last year with marked gains recorded for cyanide, silicate, soda ash, and caustic soda. Incidentally trade opinion holds that exports of soda ash were lower than the government figures show.

Potassium compounds found a smaller market abroad but solvents were in wider demand which, in some cases, may be accounted for by the fact that home markets were over-supplied and foreign markets were sought in an effort to reduce the surplus. Methanol, butanol, and acetone may be mentioned among the solvents which were shipped out in larger quantities.

Other materials in the industrial chemical division which improved their position in foreign trade last year included; glycerine, carbon bisulphide, formaldehyde, aluminum sulphate, and calcium carbide.

Export shipments of compressed, liquefied, and solidified gases fell off sharply but the net loss followed a perpendicular drop in shipments of liquefied petroleum gases. Anhydrous ammonia and chlorine registered gains in this division.

While foreign buyers took on larger commitments of pigments, paints, and varnish as a group, this increased interest was not entirely general as a reduced movement in foreign trade was reported for mineral earth pigments and white lead. Chemical pigments as a rule, however, made a good showing especially in the case of zinc oxide, carbon black, and other chemical pigments including titanium compounds. Ready-mixed paints, stains, and enamels as well as pyroxylin lacquers shared in the improvement in trade.

Imports of chemicals also were on an increasing scale so that both branches of foreign trade shared in the more general international trading movement. In round figures, imports of chemicals last year reached a valuation of $102,571,000 as compared with $79,984,000 in 1936.

Most notable was the rise in domestic receipts of fertilizer materials. Potash salts of all grades came in more freely than in preceding years and apparently held their proportionate share in the larger output of domestic fertilizers. Nitrate of soda with a larger consumption in fertilizer as well as other industries was imported far in excess of the total received in 1936.

Coal-tar importations to the value of $18,353,000 were more than 20 per cent ahead of the arrivals in 1936. The greater part of the increase was scored in the crude coal-tars with creosote oil playing a prominent part.

In the industrial chemical classification increased imports were reported for acetic acid, formic acid, ammonium nitrate, glycerine, both crude and refined, iodine, argols and wine lees.

In the sodium group, salt cake stands out with record shipments reaching this country during the last year. Gains likewise were reported in receipts of anhydrous sodium sulphate and in cyanide of soda.

For the pigment, paint, and varnish group, there was a drop in the inward movement of the finished products, including paints, stains, enamels, and varnishes. Paint-making materials, however, were in good demand and larger quantities of iron oxide, ochers and siennas, lithopone, and zinc oxide were imported from foreign countries.

Very little change was reported in the import trade in soap and toilet preparations. A marked decline was noted in the volume of castile soap reaching this country and toilet soap also reached a total considerably below the 1936 figure.

Export Trade in Chemicals Expanded Last Year

	1937 $1000	1936 $1000	1935 $1000
Coal-tar products	14,878	13,775	13,959
Medicinal and pharmaceutical preparations	17,979	14,394	12,239
Industrial chemical specialties	27,526	20,461	12,868
Industrial chemicals	27,505	22,087	23,627
Pigments, paints, and varnishes	21,544	17,789	16,345
Fertilizers and fertilizer materials	16,954	17,750	14,809
Soap and toilet preparations	9,198	8,075	7,208
Total	$135,584	$114,331	$101,055